ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 – 1346

Wetland Enhancement on an Urban River: Issues of Social and Economic Regeneration

Geoffrey Arthur Cartwright

A thesis submitted in partial fulfilment of the requirements of
Sheffield Hallam University
for the degree of Master of Philosophy

December 2003

TABLE OF CONTENTS

Page Number

Page Number

Page Number

TABLE OF FIGURES

1.0 INTRODUCTION AND OVERVIEW OF THE LITERATURE

2.0 AN OVERVIEW OF WETLANDS

Page Number

3.0 RESTORATION, REHABILITATION OR HABITAT CREATION AS REGENERATION TOOLS - AN OVERVIEW OF THE LITERATURE

4.0 THE CASE STUDY - THE RIVER DON CATCHMENT

Page Number

5.0 THE IMPORTANCE OF WILDLIFE CORRIDORS AND RESERVE NETWORKS IN SITE SELECTION - AN OVERVIEW OF THE LITERATURE

6.0 METHODOLOGY

7.0 AN INTERROGATION AND CRITICAL REVIEW OF KEY DOCUMENTATION

ABSTRACT.

With a progressive and steady decline in wetland features, particularly in lowland Britain, industry, development, agriculture, drinking water abstraction and recreation have all been recognised to have played their part in degrading riverine features, surface wetlands and underground aquifers. Much of this decline has resulted from technological development to aid industrial production and a desire for more intensive agriculture. In the late twentieth century the demise of heavy industry has resulted in large areas of derelict land ripe for redevelopment and there have been considerable changes in how land is managed for agriculture. This has presented significant opportunities for partial use of this available space for nature conservation and leisure access. The contention of the study is that such development provides a social benefit and has implications for being the backdrop to, and catalyst for, economic regeneration.

The study attempts to demonstrate this concept as it progresses through examination of the functions, aspects and processes of rivers and wetlands and relates these to people's perception of these as positive or negative. It reviews the incremental loss of riverine and wetland features and relates this to mitigation measures to negate the loss of what are now seen as crucial benefits of wetland functions. The review is then applied to a case study of the River Don catchment through a detailed examination of its historical use and change. It attempts to show the perceived importance of wetland nature conservation sites as catalysts for social and economic regeneration as it is happening in the catchment. Strategic underpinning for such contentions is examined alongside a detailed focus on existing wetland sites in the catchment and the views of key personnel in various interest groups associated with such development.

The study concludes that such nature conservation sites provide a positive benefit within areas that are undergoing significant social and economic changes but also suggests that there has been little strategic influence on where, or how, these sites are developed and promoted. The ongoing implementation of the European Union's Water Framework Directive may change this but the study suggests that this may come as a significant 'culture shock' to those who are likely to implement its recommendations on individual river basins. The influence of 'project champions' is recognised as having been a critical factor in existing project development and management.

The research study advances the knowledge and understanding of the strategic influence of wetland development in social and economic regeneration by drawing together disparate sources of influence, through evidence of existing project influence, and through the experience of key players in the field. This will help provide vital preparation for personnel involved in the forthcoming implementation of the Water Framework Directive.

ACKNOWLEDGEMENTS.

The author extends his gratitude to the following people for their help with this research project:

* Former professional colleagues including Simon Ogden, Richard Watts and Ric Bingham from Sheffield City Council; John Rotherham from Rotherham Borough Council; Martin Nowacki from Doncaster Borough Council; who all acted as 'sound boards' for ideas and in providing an 'industry' view of the research project .

* Those people who kindly agreed to be interviewed or provide information for the study - Val Greaves, Simon Ogden, Annie Cooper, Phil Tierney-Kitchener, Martin Nowacki, Phillipa Harvey, Kathy Hamilton, Roger Mitchell, Harry Bowell, Nigel Doar, Christine Handley, Stuart Pasley, Tim Kohler, Richard Walker and Chris Firth. Also, to the respective organisations employing these staff for their permission for their responses.

* At Sheffield Hallam University thanks are due to the School Executive for financing the project, to the author's supervisory team of Ian Rotherham, Colin Beard and Mel Jones for their help and guidance. Also to Joan Butt for assistance with the production of graphics, to Dave Egan for insight into environmental economics, to Keith Harrison for use of his maps and to John Rose for his help, patience and advice in relation to the mysteries of information technology.

* Finally, and most importantly, to my wife, children and friends for their unquestioning encouragement and unstinting support through a series of extremely traumatic personal events that occurred during the course of the project.

1.0 INTRODUCTION AND OVERVIEW OF THE LITERATURE.

1.1 Setting the scene.

As part of the hydrological cycle the passage of water in rivers is one of the few constants in nature. Other than in times of severe drought, its unstoppable progress, from its source in precipitation on the hills to its sump in the sea, is only likely to be capable of change through human intervention. This could be through being diverted; or temporarily stored in reservoirs; or speeded on its way in engineered channels; or abstracted for commercial and domestic use; or even hidden in pipes and culverts. But, eventually, that which has not dissipated through evapo-transpiration, will reach the sea.

Water has always been the focus of life, without it all organisms would be extinct. Early human settlements developed around sources of water in order to maintain access to drinking water and, as agriculture developed, water was also needed for irrigation of crops. Industrialisation mainly developed around rivers and streams to utilise the power of the water to move machinery and in more recent times humanity has also looked to water for recreational pursuits. For other forms of life, habitat-types have developed around water and wetlands and have provided ecological niches for 'specialist' organisms.

Water is of prime importance to humanity yet it has been abused in many ways. There is a historical continuum of a love/hate relationship with rivers and wetlands as they can be associated with disease, with getting lost, with superstition, with drowning and 'sinking into the mire'. Deeply ingrained in the corporate psyche is the perception of wetlands as wastelands (Rotherham and Cartwright, 2000). Yet equally they are respected for their beauty, for their wildlife, for their recreational opportunities, for food, for other products, for their ease of transport, as a source of power, as a cooling medium and as a cleansing medium.

One of the most important features of these relationships has been humanity's desire to control the medium of water through compounding it, channeling it, diverting it, polluting it and, in recent times, ignoring its power by developing on riverine flood plains. Gardiner (1998) claims that humankind has exploited nature for many centuries but, until the nineteenth century, has always respected the functions of natural forces and the conservation of natural resources. Settlements may well have developed in flood plain areas but the dangers of flooding were recognized with properties being built on the 'islands' of higher ground. He suggests that, since the beginning of the Industrial Revolution, development has ignored such basic considerations with the consequent loss of habitat, scenic beauty and 'natural' products. He states that this

decimation is dictated by short-term economics mixed with political expediency and inadequate legislative or planning controls. The penalties for taking such risks have been very evident in the storms of the autumn of 2000, where rivers reclaimed their flood plains over huge areas of the country with resultant damage to property and loss of agricultural crops.

This study will examine these issues using general literature and through examining, as a case study, the features, threats and opportunities of the River Don, which flows mainly through the county of South Yorkshire.

1.1.1. Water as the 'blood' of life.

"Rivers are the natural arteries of a country; they distribute fresh water to sustain life processes and have historically diluted and dispersed effluents from human activity. They have shaped the landscape and provide the basis for much of our economy and recreation. The health and well-being of a country can be judged by how it looks after these natural systems, so that they remain in good health despite being put to a variety of uses" (Hutchings, online, 1999).

The use of particular words in this quotation provides an emotive view of the value of water. There are strong comparisons to bodily processes through the employment of such terms as "arteries", "life processes", "health and well-being" and "natural processes". In doing this it demonstrates the reliance of all forms of life on this substance. Burton (1982) quotes the Speaker of the House of Commons, in his address to the Lords in 1655 as saying:

"*Cosmographers do agree that this Island is incomparably furnished with pleasant Rivers, like Veins in the National Body, which convey the Blood into all the Parts, whereby the whole is nourished and made useful*".

O'Sullivan (1995) and Maltby *et al.* (1998) reinforce the suggestion that great emphasis should be placed on the importance of Europe's wetlands for both humans and wildlife. They reiterate that wetlands provide our drinking water, irrigation for our food crops, nourishment in the shape of edible fish and other animals, water for our factories, as well as building materials and fuel. They provide transport routes, defences against flooding, and recreational opportunities; they even help control our climate. They affect groundwater recharge/discharge, sediment/toxicities retention, and biogeochemical cycling. Pearce (1990) describes the functions and services of the most threatened wetland types as shown in **Figure 1.1**.

Wetland types	Functions / services
(1) Flood plains	Flood storage; flood protection; wildlife habitats; nutrient cycling/storage and related pollution control; landscape value; agriculture; recreation (including hunting); reduction of water erosion impact; storage of groundwater and recharge.
(2) Coastal wetlands	All those listed under (1) above, with the exception of aquifer recharge; shoreline protection/storm damage buffer zones; recreation; extended food web control; salinity balance mechanism; commercial goods output.
(3) Wet meadows	High biodiversity; hydrologic cycle control; landscape; water quality and aquifer storage; buffer zones for agricultural run-off; recreation.
(4) Peatlands	As (3) above; global atmospheric cycle; resource extraction (energy and non-energy); specialised habitats.

Figure 1.1. **Functions / services of the most threatened wetland types.**
(Adapted from Pearce, 1990).

O'Sullivan (1995) goes on to say that wetlands provide a wealth of habitats for a vast array of animals and plants, and this wildlife is itself greatly valued by people for a wide variety of reasons. He states that, despite their obvious importance to humanity, scarcely a European wetland is unaffected by humans. This clearly exposes one element of a dichotomy in the human experience of water that, in order to exploit water and its environs, humanity has a history of significantly changing the wetland landscape. But a second dichotomy for people is that at numerous points of time in the country's history there have been distinct contrary viewpoints and attitudes towards water and wetlands. Burton (1982) quotes an old Oxford English Dictionary definition of 'river' as being '*the boundary between life and death*'. Purseglove (1988) lists many historical comments relating to wetlands as hostile environments associated with noxious gases, bogland, fear of flood, and diseases such as malaria, bubonic plague (via its link to wetland-dwelling rats), typhus and cholera. Early laws of the country were related to the spread of water-borne diseases in urban areas. Current thinking on global warming and climate change would suggest an increased incidence of insect-borne disease (for plants and animals) and an increased occurrence of storms and flooding will become more regular features of life in the UK (RSPB, online, undated[e]). Giblett (1996, p.1) comments:

"Wetlands are not always, and for some not ever, the most pleasant of places. In fact they have often been seen as horrific places. In the patriarchal western cultural tradition wetlands have been associated with death and disease, the monstrous and the melancholic, if not, the downright mad. Wetlands are 'black waters'. They have even been seen as a threat to health and sanity, to the clean and proper body and mind. The typical response to the horrors and threats posed by wetlands has been simple and decisive; dredge, drain or fill, and so 'reclaim' them. Yet the idea of reclaiming wetlands begs the questions of reclaimed from what? For what? For whom? A critical history of wetlands' drainage could quite easily be entitled 'Discipline and Drain'.

Yet many people would also suggest that water features are places of beauty and tranquility, are rich in wildlife and they provide an invaluable economic and social resource. Kenneth Graham's classic children's novel *The Wind in the Willows* demonstrates a mystical love of water:

"Suddenly he came to the edge of a river - never in his life had he seen one before. All was a-shake and a-shiver, gleaming and sparkling. The mole was enchanted".

Ted Hughes (1983), former Poet Laureate, in a collection of his poems about rivers, expresses this dichotomy of 'good' (life-giving) and 'evil' qualities of rivers:

"This is the sun's oiled snake, dangling, fallen,
The medicinal mercury creature
Sheathed with the garb, in all its inscribed scales,
That it sheds
And refreshes, spasming and whispering.
Spinal cord of the prone adoring land,
Rapt
To the roots of the sea, to the blossoming
Of the sea".
(Extract from *Flesh of Light*).

"So the river is a god
Knee-deep among reeds, watching men,
Or hung by the heels down the door of a dam
It is a god, and inviolable.
Immortal. And will wash itself of all deaths.
(Extract from *River*).

"And the river
Is a gutter of death,
A spill of glitters dangling from her grasp
As she flies
Through the shatter of space and
Out of being". (Extract from *Japanese River Tales*).

The painting and cartoon shown in **Figures 1.2 and 1.3** radically demonstrate this 'love/hate' perception of wetlands with the Millais painting showing a 'prettified', almost ethereal, wetland scenario (despite Ophelia's suicide!) and the supposed frightening horror described in the cartoon comic.

Figure 1.2: "Ophelia" (1851 -1852) by Sir John Everett Millais. (Source: Tate Gallery, London.)

Figure 1.3: **Frontispiece for "The Saga of the Swamp Thing" comic.**

(Source: DC Comics, US.)

But Burton (1982) suggests that however much we may romanticize a river, exclaim over its beauties or disclaim on its usefulness, it is, in fact, a drain. However, the Department of the Environment, Transport and the Regions (2002) in its guide to water protection in England and Wales supports this perception of the life-giving characteristics of water:

"Water is essential for life. It also plays an important part in the economy of a modern country like ours. Ensuring that our water resources are understood, respected and managed correctly is vital for our future. Coping with the various demands for water, and seeking to maintain and improve the quality of our waters, is an important and sometimes difficult challenge. Rivers, estuaries, coastal waters and water held underground are all integral parts of the natural environment. Careful planning is needed to protect and conserve them, and to ensure that the water they supply is suitable for a wide variety of uses" (Anon., online, undated [a]).

It is also now accepted that human contact with 'nature' (Ulrich et al., 1991 and Rohde and Kendle, 1994) enhances psychological well-being.

Mitsch and Gosselink (1986) give evidence that wetlands are found on every continent in the world other than Antarctica and suggest that 6% of the land surface of the world is wetland. But they also comment that, although many cultures have lived among and even depended upon wetlands for centuries, modern history of wetlands is linked to misunderstanding, fear and over-exploitation. Pickering (1996) suggests that, before rivers were channelled, embanked and diverted by people, they would seasonally flow outwards across substantial lowland flood plains, leaving pools and ponds in natural depressions as they receded in summer. Most of the United Kingdom's major, lowland river valleys were once networks of wet grasslands, reedbeds, sedgebeds and willow or alder carrs, which were linked to a river course that constantly shifted. Adams (1991) supports this supposition by stating that there can be little argument that, in general terms, the original countryside was more interconnected than at present, and that habitat connectivity declines with human modification of the landscape.

Considerable areas of the UK were thus covered by a diversity of wetland environments, and agriculture developed in harmony with this shifting seasonality. Certain commercial ventures in particular parts of the country also developed to make use of the wetland crops - the use of osiers in the Somerset Levels and Trent Valley, and reed and sedge cutting for thatch in the East Anglian Broadlands are obvious examples (See **Figure 1.4** below). Furthermore, whilst they are particularly known from these areas, many of these activities would have occurred much more widely in former times.

Figure 1.4: **Commercial reed-cutting in the Norfolk Broads.** (Source: David Holmes)

1.2 Rationale for the study.

This study is a direct response to an increasing interest in wetland environments and their integrated social, economic and conservation potential. There has been an increasing recognition of a steady decline in wetland features, particularly in lowland Britain. Industry, development, agriculture, drinking water abstraction and recreation have all played their part in degrading riverine features, surface wetlands and underground aquifers; although there now appears to be a desire to make use of such sites in an integrated and sustainable way. This is partially evident from a conference to promote a management handbook on "Industry, Wildlife and Wetlands" (Merritt, 1994), where conservationists, water companies and industrial concerns came together with an attitude of exploring the possibilities rather than defending their 'rights'.

The Earth Summit in Rio de Janeiro in 1992 has also had a dramatic effect on local issues and has begun to generate an atmosphere of co-operation between agencies that once had no common ground. 'Biodiversity' and 'sustainability' are now terms that are being used in diverse scenarios. Strategic viewpoints are becoming commonplace compared to the narrow focus of specific site development of recent years.

The majority of the River Don catchment is easily accessible to the large population centres within South Yorkshire and has become an important focal point for economic, social and environmental regeneration. In his milestone report *Towards an Urban Renaissance*, Lord Rogers set out a vision for urban regeneration, founded on the principles of design excellence, social well-being and environmental responsibility. He suggests that if we fail to promote urban living within the context of a sustainable urban environment, we will increase social deprivation; accelerate the depletion of natural resources and damage biodiversity (Office of the Deputy Prime Minister, online, 1999). The regeneration of the environs of the River Don and its tributaries will be a crucial lynchpin in achieving Lord Rogers' ambitions within South Yorkshire.

It is now common to examine issues in a European dimension, drawing on the skills and experience of our neighbours in the European Union and further afield. This study refers to case study examples at both regional and national levels, and with selected sites in mainland Europe where specific catchments are being examined in a similar way (two such European case studies are outlined in **Appendix 1**). Particular emphasis is given to local partnerships and contact with relevant agencies.

The primary purpose of the study is:

To increase the knowledge and understanding of the issues relating to water and wetlands as key components of regional environmental, social and economic resources.

There are also a number of secondary purposes of the study and these are shown in **Figure 1.5**:

* ***To critically review the relevant regional strategies.***
* ***To assess the current status of key wetland environments and habitat-types in the River Don catchment.***
* ***To evaluate and document the historical changes within this landscape; relating this to a review of the contemporary ecological resource, its conservation and recovery.***
* ***To consider site selection criteria and to develop a strategic approach for the integrated enhancement of the catchment, including development for conservation linked to social and economic renewal.***
* ***To critically examine existing case studies, with regard to site selection criteria, resource provision and funding, and socio-economic influences.***
* ***To consider the economic and leisure/tourism implications of all the above.***

Figure 1.5: Secondary purposes of the study.

1.3 Scope of the study.

The background to the critical research for this project examines the suggestion that strategic integration of environmental projects in the social, political and economic development of a region is of singular significance. Policies and initiatives at international, national, regional and local levels will be of influence in this issue. The study will examine such influences and apply resultant concepts in their applicability to the case study area of the catchment of the Rivers Don, Dearne and Rother which lie mainly in the county of South Yorkshire. Of critical importance in relation to the primary aim of the research in this region is the supposition that:

1. ***Wetland management, enhancement and creation (all aspects of restoration and rehabilitation) may present significant opportunities as a platform for regeneration and for balancing former environmental loss and degradation.***

2. ***Wetland restoration projects are critical in facilitating social and economic regeneration at local and regional levels.***

These form the aims of the research.

Wetlands are extremely important in people's lives in terms of their aesthetic and spiritual values alongside the more practical functions listed earlier in **Figure 1.1**. Increasingly, there is also recognition of their other economic functions of tourism and recreation together with a growing awareness of environmental sustainability and biodiversity at local and governmental levels. The project will reflect other issues as shown in **Figure 1.6**.

Other issues of relevance to the study:

* A potential reduced need for the use of marginal land for agriculture;
* An increase in the storage area provision in floodwater alleviation schemes;
* An increase in restoration schemes in former deep and opencast mining areas;
* The recognition that surface wetlands are a key component in maintaining and recharging our underground aquifers (Hughes, 1992) [possibly depleted in the eastern area of the Don catchment by a growing demand for crop irrigation];
* The use of wetlands as a means of pollution prevention and waste processing.

It will also address an increasing interest in sustainable management of existing wetlands and the potential for creating new ones.

Figure 1.6: Other issues of relevance to the study.

Historically, the River Don catchment has provided the means for industrial development in the region since the Industrial Revolution. In association with this, there has been a rapidly expanding population around the urban centres of Sheffield, Rotherham, Barnsley and

Doncaster, placing increasing pressure on the more rural parts of the lower part of the catchment for urban fringe-related land uses such as housing, road building, quarrying and landfill (Moss, 1995). Heavy industry has suffered a huge decline in its core industries of steel, coal, cutlery, and tool manufacture with an associated collapse of employment. Steel-based employment in the Lower Don Valley in Sheffield declined from 40,000 to 13,000 jobs between 1975 and 1988, along with a legacy of dereliction and despondency (Rotherham and Cartwright, 2000). One consequence of unemployment is that people have more time for, interest in, and access to leisure pursuits. Kendle and Forbes (1997) speculate that the re-introduction of wild areas to the urban environment is, for many people, a means to compensate for the loss from their everyday lives of the aesthetic, spiritual and recreational values which characterise the natural environment.

Sites for nature conservation within urban areas also play a major part in providing an experience that imparts a conservation message important in today's individualistic and consumerist society. This is despite the contention of Bocker (1991) that the public often perceive wildlife and the city environment as totally incompatible; nature conservation having been associated with the more natural landscapes of the countryside rather than with cities. Initiatives are being made to change this perception through provision of sites acting as interfaces between people and nature through the use of environmental education and interpretation. For example, the main purpose of the Blackburn Meadows nature reserve in Sheffield is targeted at providing a 'nature' experience for local people in a socially-deprived community in the industrial heartland of the area (Cartwright, 2000). The study will examine aspects of development and visitor management (including environmental education) at specific sites. The legacy of pollution is one of large areas of contaminated land, poor air quality and poor water quality. The dereliction following decline in the area's traditional heavy industries, often sited alongside rivers, has opened up new opportunities for regeneration, which can include both nature conservation and recreational features. **Figure 1.7** shows the former Templeborough steel works as a backdrop to the Blackburn Meadows nature reserve. This building once housed electric arc furnaces but has now been converted into the Magna discovery centre for children, based on the elements of earth, fire, air and water - crucial to steel-making.

Figure 1.7: The Magna centre and Blackburn Meadows nature reserve. (Source: Ric Bingham).

1.4 Objectives.

The objectives of the study are shown in **Figure 1.8**:

* To critically review existing theoretical and empirical research within the field of study.
* To critically review national and international initiatives and guidelines alongside regional and local policies relating to land use in the study area.
* To document and describe the environmental, social and economic factors affecting selected wetlands in the catchment.
* To document existing and potential wetland environments and sites of significant size within the study area.
* To investigate what local measures are planned, have been implemented or are currently being implemented in relation to the stated elements of this study.
* To critically review strategic policies affecting catchments and wetlands at international, European, national, regional and local levels.
* To investigate particular issues and opportunities.
* To investigate ideal site selection criteria and compare them with those utilised for existing developments.

Figure 1.8: The objectives of the study.

2.0 AN OVERVIEW OF WETLANDS.

2.1 Definitions.

There are more than fifty definitions for the collective term 'wetlands' in use throughout the world (Anon., undated [b]). The word is not easy to define and could include a multitude of different habitat types. Mitsch and Gosselink (1986) describe wetlands as being the mid-point between truly terrestrial ecosystems and truly aquatic ones, and to complicate things further, they have characteristics of each of these adjoining ecosystems. Place names that may be of a very local nature will also influence our understanding of the term. Even such terms as 'marsh' are very ill defined, non-specific and mean different things to different people in different areas of the country.

The Ramsar Convention (sponsored by UNESCO in Ramsar, Iran in 1971) defines wetlands as *"areas of marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres"* (Denny, 1994, p. 250). Even this is insubstantial, yet it is a generic term useful in policy formulation. Allaby (1979, p. 516) in the Dictionary of the Environment defines a wetland as *"an area covered permanently, occasionally, or periodically by fresh or salt water up to a depth of six metres (e.g. flooded pasture land, marshland, inland lakes, rivers and their estuaries, intertidal mudflats)"*. Haslam (1973) describes wetlands as *"areas dominated by emergent aquatics (hydrophytes or helophytes) or, at the drier end of the range, areas potentially dominated by these (excluding woods and carrs), together with the outer fringe of adjacent habitats of either open water or carr"*. Haslam goes on to suggest that this definition allows the listing (see **Figure 2.1** overleaf) of different types of wetland but with the proviso that intermediates can occur and the some wetlands could be placed in more than one category.

Types of wetland:

1. **In or near watercourses:**

   a) shallow lowland brooks (common dominants: *Rorippa nasturtium-aquaticum, Sparganium erectum*),

   b) shallow dykes, usually on alluvial plains (common dominants: *Phragmites australis, Typha* spp),

   c) fringes of rivers, canals, drains *etc.* (common dominants: *Glyceria maxima, Sparganium erectum*),

   d) (i) flood meadows beside water courses, liable to winter flooding, this often being caused by the general water level rising above ground level,

   (ii) washlands, wetter than flood meadows and receiving floodwater spreading laterally from the watercourse and for a longer period (vegetation varies with water table and use, from grass sward to *Phragmites australis*, for example),

   e) valley bogs of high nutrient status (common dominants: *Carex paniculata, Phragmites australis*).

2. **In or near lakes or ponds:**

   a) margins of open water (common dominants: *Phragmites australis, Schoenoplectus lacustris*),

   b) silted ponds (common dominants: *Phragmites australis, Typha latifolia*).

3. **In large low-lying alluvial plains (in addition to I b), c) and d) above):**

   a) on fen peat; fens, reedswamps, etc. (common dominants: *Phragmites australis, Cladium mariscus),*

   b) on mineral soil; marshes reedswamps, *etc.* (common dominants: *Phragmites australis, Glyceria maxima*).

4. **In coastal areas:**

   a) salty (e.g. *Spartina townsendii*),

   b) only slightly salty (e.g. *Phragmites australis*).

Figure 2.1: **Types of wetland.** (Source: Haslam, 1973).

In 1975 the Nature Conservancy Council commissioned academics from three universities to provide a systematic and comprehensive classification of British plant communities (Rodwell, 1995). The resultant five-volume text represents the National Vegetation Classification. The plant communities thus defined are extensive and appear very complex. Wetland communities are described in all five volumes. It is not intended to seek to utilise these individual descriptive vegetation community definitions for this study but to recognise that this level of detail exists and is crucial to restoration and creation projects.

Although these definitions are very complementary, for the purpose of this study the generic definitions used by both Merritt and Maltby will be employed. Merritt (1994, p. 2), describes wetlands as *"any habitat characterised by standing water or a saturated soil for a large part of the year".* Maltby (1986, p. 28) defines wetlands as *"ecosystems whose formation has been dominated by water, and whose processes and characteristics are largely controlled by water. A wetland is a place that has been wet enough for a long time to develop specially adapted vegetation and other organisms".*

2.2 Wetland decline.

Newbold (1998) suggest that, before the advent of major drainage schemes and land use changes around 2,000 years ago, it is estimated that there were two million hectares of flood plain. Their distribution is shown in **Figure 2.2**.

Figure 2.2: Flood plain distribution 2,000 years ago. (Source: Newbold, 1998).

It has also been estimated that as much as a quarter of the British Isles was covered by wetlands prior to the arrival of the Romans (Rackham, 1986). Fog and Lampio (1982) suggest that few of the world's major habitat types have suffered as drastically from human abuse of the environment as wetlands. Today, at most, only 5% of the UK consists of wetlands. In Europe wetland degradation and loss has been prolific in the last century, largely as a result of increasing agricultural development and pollution (Jones and Hughes, 1993). As an example of this decline, since 1930 40% of wet grasslands are estimated to have been lost (RSPB, 1992). In Southwest England 92% of wet pastures have been lost this century whilst the area of grazing marshes in the Thames Estuary has fallen by 28,000 ha (65%) since 1930 (Institute for Systems, Informatics and Safety, online, undated). The United States Department of the Interior (1994) suggest that the most important economic sector absorbing wetlands is the agricultural sector quoting a figure (to 1985) of 37.5 million hectares of the nation's cropland having been developed by draining land.

In March 1998 the RSPB, together with English Nature, announced that 80 of England's top wetland sites were in danger from sewage pollution or from the over-abstraction of water. The 80 sites are all designated Sites of Special Scientific Interest (SSSIs) with 37 of them being proposed as Special Areas of Conservation under the European Habitats Directive or Special Protection Areas under the Birds Directive (RSPB, online, undated [a]). Norris (2002) reports that Snipe have disappeared from two thirds of the areas where they once bred.

Sutherland (2000) suggests that conservation problems largely result from increasing human populations, new technologies and our increasing expectations. Muir and Muir (1986) propose that the pacification of wetlands and flood plains is normally presented as 'progress' yet, under closer examination, the changes do not always appear to have been beneficial. Most people are aware that rivers are useful as well as beautiful. Yet, as Maltby *et al.*. (1998) state, wetland degradation and loss continues throughout Europe despite the increasing weight of scientific evidence underlining their environmental significance. Goudie (1981) and the Flood Hazard Research Centre (Online, undated) suggest that there are many ways in which humans influence and degrade water quality and quantity in rivers and streams – for example, by direct channel manipulation, modification of watershed characteristics, urbanisation, transportation and pollution (see **Figures 2.3 - 2.6** overleaf). Goudie and Viles (1997) report that global water use has more than tripled since 1950 and, at the time of writing stood at 4,340 cu km per year (the equivalent of eight times the annual flow of the Mississippi River).

Figure 2.3: Canalisation on the River Sheaf.

Figure 2.4: Urban canalisation of the River Porter.

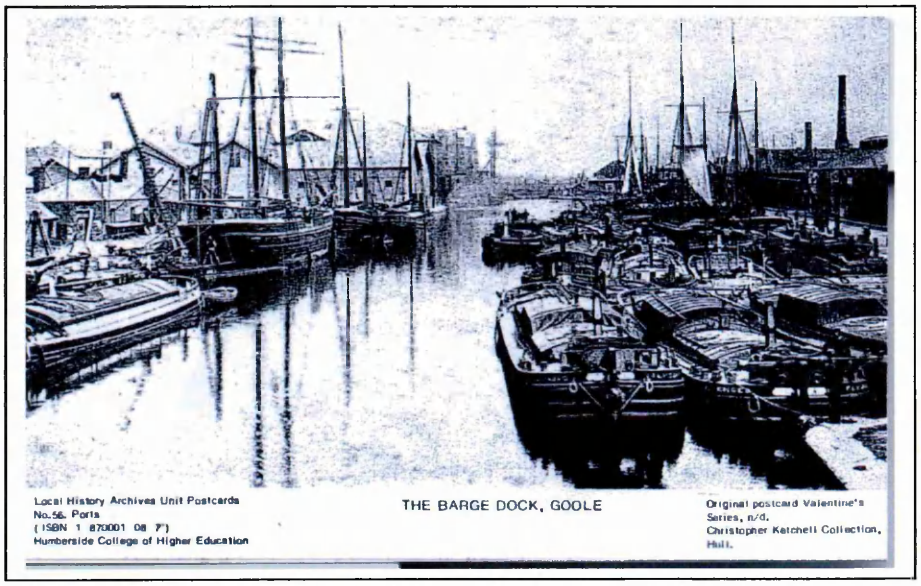


Figure 2.5: The Barge Dock, Goole. (Source: Humberside College of Further Education)

Figure 2.6: Sewage effluent outlet to the River Don at Blackburn Meadows. (Source: Author)

Doyle (1997) proposes that as many as twenty-one of the 822 fish species native to American rivers and lakes have become extinct since the time of the first European settlement. He also quotes data obtained from the Nature Conservancy (USA) which shows that another 297 species (36% of the total) are currently at risk of extinction.

Much loss of wetland in this country can be attributed to drainage of land for agriculture although industrial and housing development, flood defence and waste disposal have also played their part. It would seem that there has been a change of attitude towards wetlands with them being viewed as wastelands (Institute for Systems, Informatics and Safety, online, undated; Moss, 1998; Rotherham and Cartwright, 2000) or as potential areas for "more productive use" (Wentz, 1988). However, the Worldwide Fund for Nature's (WWF) Wise Use of Flood plains LIFE Environment Project suggest that it is essential to recognise that there are many other factors than those listed above which may affect the loss or degradation of flood plains/wetlands. These include a wide range of political, institutional and administrative processes which influence delivery of sectoral policies which are shown in **Figure 2.7** below:

* The lending policies of financial institutions;
* Inconsistencies between 'paper' laws/policies/incentives and actual implementation;
* Reassessment of traditional engineered solutions to flood management;
* Complexity of land ownership systems;
* Complexity of administrative systems;
* Distorted land values;
* Protected area designations;
* Difficulty of predicting accurately the precise result of a restoration proposal
* Access to information on opportunities and techniques for restoration;
* degree of political will. (WWF, November, 2000).

Figure 2.7: Processes which can influence the delivery of sectoral policies.

As well as through human intervention, more natural processes can also account for some of this loss through neglect of habitat maintenance, as wetlands will only remain as such if they are managed at a particular point of the seral succession. The tendency is for them to progress over time towards drier communities and scrub. Aligned with deterioration in water quality and

quantity, and lack of management, these developments have left only small pockets of good, semi-natural wetland environment.

Climate change is already beginning to have an effect with some species physically extending their range northwards. There is still debate as to whether this is part of a natural, changing climatic event or whether it is as the result of global warming, but it is clear that farming practices and cropping patterns will change as the climate changes (Bailey, 1998). Because of this surface water run-off will be affected. New crops will be grown, new pests and diseases will arrive and summer irrigation will increasingly be required (if fields are not already waterlogged) with a consequent impact on water sources (RSPB, online, undated [e]). Bailey (1998) also reported that in general, precipitation exceeds evapo-transpiration and, therefore, there is a drainage problem. The UK, during the time of researching this study, has suffered some of the worst storms and flooding for many years and this is likely to become far more frequent with increasing erosion to coastlines and within river basins. Unfortunately, previous responses to major flooding events and the fear they generate, have resulted in socio-political pressure to sponsor canalisation in order to speed water more quickly out of the threatened area (Gardiner, 1998). This has little regard for consequences of such action downstream. Scottish Natural Heritage (Anon., 2002 [a]) suggest that careful attention must be given to flood defence works if they are not to damage the freshwater natural heritage and should develop flood alleviation options which seek to work with natural processes rather than against them This may, in the long term, prove less expensive overall, and may well result in significant natural heritage benefits.

Until relatively recently the economic viability of the commercial use of fens and reedbeds by harvesting, grazing and peat cutting had significantly declined. However, Green (1996) suggests that some wetland products are still commercially exploited. He reports that there is a thriving, if rather specialist, market for reed for thatching and in some European countries reed is now harvested on a much bigger scale for paper manufacture. But the general downward trend of such initiatives has produced a fear that commercial wetland neglect could result in an even greater rate of loss of wetland areas throughout the country through drying out and the prospect of development. English Nature (1994) express concern, not only about the loss of reedbed habitat, but also about the neglect of remaining sites. Estimates of habitat loss vary but may be as high as 40% (Bibby *et al.*, 1989). However, Hawke and Jose (1995) report a resurrection of the thatching industry and a desire to use home-grown reed giving an incentive for the restoration of existing reedbeds and the creation of new ones.

An associated effect of this decline has been population decreases or local extinction of wetland species. One example of this major cause for concern is exhibited through the RSPB's promotion of reedbed creation and management for bittern (*Botaurus stellaris*); a species which has reached crisis levels as a breeding population in the British Isles (Burgess and Evans, 1989; Tyler, 1994: Smith *et al.*, 2000). Hawke and Jose (1997) report that, prior to the large-scale drainage schemes of the seventeenth century; bitterns must have been more widespread and abundant than now. According to Voisin (1991) and Tyler (1994) bitterns are extremely specialised for life in the reeds and are restricted, in the main, to large expanses of unbroken reedbed dominated by common reed (*Phragmites australis*) growing on lowland swamps. They avoid reedbeds where the water level fluctuates markedly and where the water is too acid. For foraging the species is very dependent on the presence of shallow pools of standing water, scattered amongst dense stands of new reeds which are sturdier and make less noise when climbed upon. In the 1950s there were an estimated 70 – 80 booming males in Britain (Day and Wilson, 1978) but by the 1970s and 1980s numbers of the species had significantly reduced, possibly as a result of pollution, disturbance and habitat destruction, or neglect (Day and Wilson, 1978; RSPB, online, undated [d]; Jose, 2000). As the species is extremely secretive the number of breeding bitterns is estimated from counts of males booming in spring as part of their breeding display. Trends in the counts of booming males over the last thirty years are shown in **Figure 2.8**.

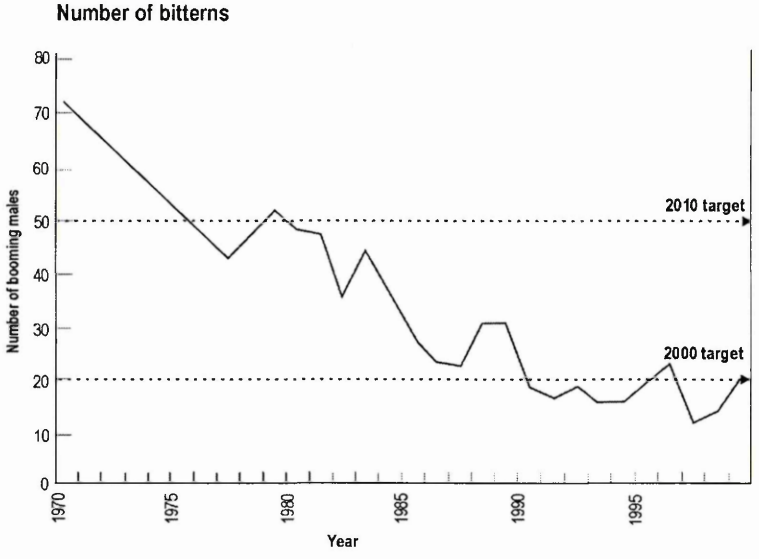


Figure 2.8: Trends in the number of booming male bitterns in the UK, 1970 – 2000. (Source: RSPB/BTO, 1999)

The RSPB is currently conducting research into the species' recovery, breeding success, prey species and habitat usage. A further project is looking at the management of reedbed/mere systems for fish populations (RSPB, online, undated [f]).

It could be argued that the species is at the edge of its range in the UK and therefore liable to fluctuations in breeding success and should be left to find its own level and range. The argument against this being that the decline is due to human influence on habitat which is not a 'natural' modification. There is also a suggestion that, given wide acceptance that the world's climate is changing, Britain will experience milder winters, drier summers, increased rainfall, increased storm frequency, increased wind speeds and sea-level rise. This could have significant effects on the country's wildlife, particularly rare species such as the bittern which has such specific habitat requirements (Percival, 2000). Despite these concerns as to whether the bittern will ever recover its breeding territory in the UK, the species has now been included in the UK Government's Biodiversity Action Plans (Anon., 1995[a]). A grant of £1.5 million has been given by the European Union's LIFE programme to a partnership of conservation organisations for habitat enhancement, management and creation. This is currently being used to restore, create and extend reedbeds across the UK (RSPB, online, undated [c]; Smith *et al.*, 2000; Jose, 2000). One site that will be subject to a large reedbed creation project is at Potteric Carr nature reserve near Doncaster, one of the case study sites described later in this study. In the spring of 1999, a modest rise from eleven to nineteen booming bittern males, mostly on managed sites, was recorded, suggesting that these actions are beginning to have effect (RSPB/BTO, 1999). However, the count of booming males in the 2003 breeding season for the UK was less than twelve (RSPB, personal communication). Well managed wetlands provide the best habitat and those that are of large size (*c.* 40 hectares) tend to attract species such as bittern and marsh harrier (*Circus aeruginosus*), both of which are considered to be threatened species within the UK Biodiversity Action Plans (RSPB/BTO, 1999) (See **Figures 2.9 and 2.10** below).

Figure 2.9: **Marsh harrier over reedbed.**
(Source: Author).

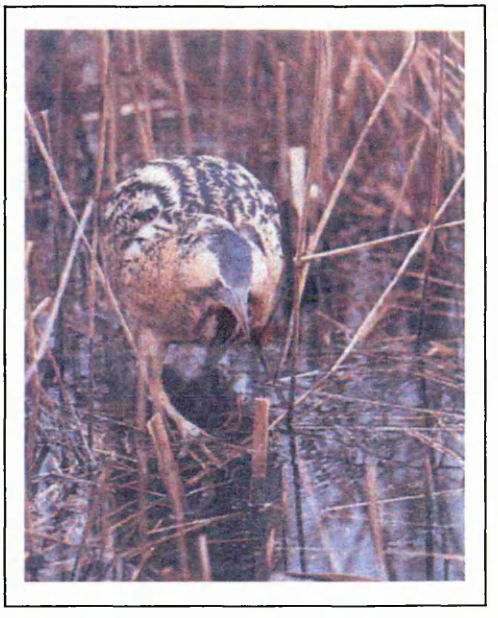


Figure 2.10: **Bittern in reeds.**
(Source: RSPB Image Library).

Bibby and Lunn (1982) stated that only fifteen reedbed sites exceeded 40 hectares in a survey conducted in 1979 and 1980. However, small areas of reed can be important for wildlife as an area of only several square metres can support a nesting reed warbler (*Acrocephalus scirpaceus*) and a range of invertebrates (Hawke and Jose, 1997). Industrial use of wetlands and their value for wildlife can be compatible. The development of reedbeds for wastewater treatment has been an exciting and innovative step and there is recognition that such solutions are efficient, cost-effective, have good promotional potential and real environmental gains (Merritt, 1994).

2.3 Wetland pollution.

Rivers are the conduits by which we dispose of our effluent, whether through authorised consent via domestic sewage treatment works and industrial treatment processes, or through unauthorised events such as leachates from landfill sites, farm slurry events or agricultural chemical leachates. There is no doubt that many of Britain's rivers have been over-exploited and abused, particularly during the last two centuries, and especially in urban areas. Sutherland (2000) suggests that most conservation problems are a result of some damaging operation providing a short-term profit to certain individuals but result in loss to others. This abuse has resulted in changes to flow regimes, pollution and degraded physical environments. **Figures 2.11 and 2.12** demonstrate air pollution in the Don catchment and the proximity of water-polluting metal industries towards the beginning of the last century.

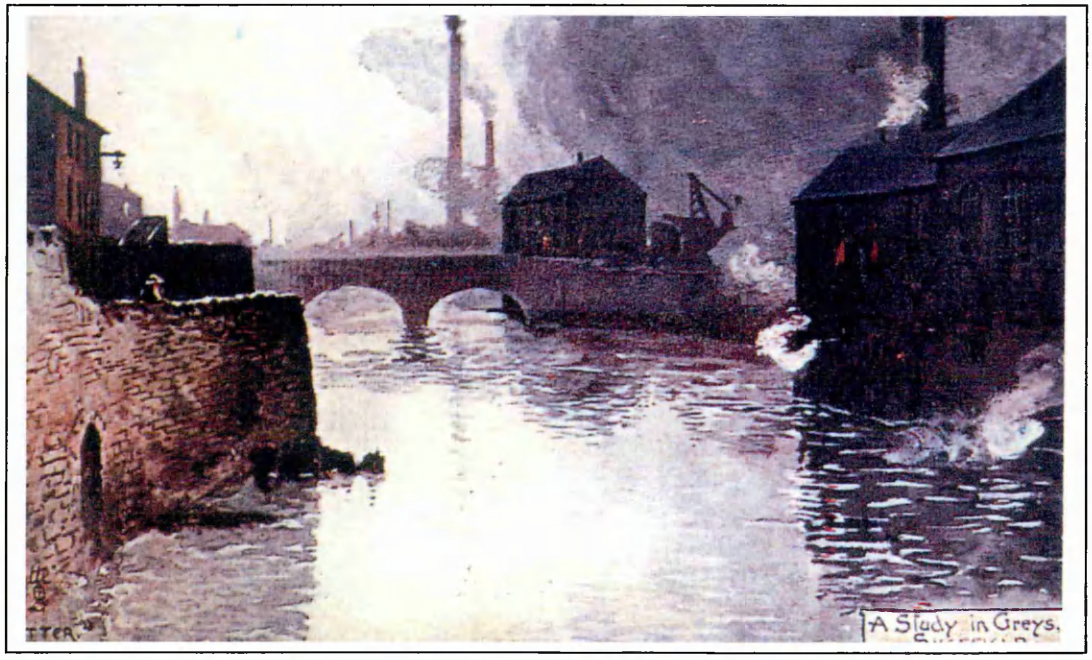


Figure 2.11: **"A Study in Greys"** (Source: E.T.W.Dennis and Sons Ltd., Scarborough)

Figure 2.12: **"White Rails"** (Source: E.T.W.Dennis and Sons Ltd., Scarborough)

Figure 2.13 shows an industrial outlet on the Blackburn Brook, Sheffield.

Figure 2.13: **Polluting industrial outlet, Blackburn Brook, Sheffield.** (Source: Author).

Newson (1992 [a]) proposes that human development and its changing lifestyle requires that waste is created and must be disposed of. Surface drains are relatively easy to identify, their flows are contained and visible and can be gauged and monitored. These are point source pollution outlets. Polluted waters that leach into the soil and later into watercourses or groundwater are not so easy to see and their routeways not easy to predict. These are diffuse or non-point source pollution outlets. The Department for the Environment, Food and Rural Affairs [DEFRA] (2002) have defined diffuse pollution as being pollution arising from land use activities, both rural and urban, dispersed across a catchment, and is distinct from point source pollution or effluent disposal at fixed, recognised outlets. In describing examples of point source outlets Newson also suggests that the most obvious is the outfall of a sewerage system which often discharge foul-smelling and discoloured water, obviously polluting the watercourse. Most sewage effluent is treated and returned to the river in a less polluting form but sewage treatment works are rarely designed to cope with storm conditions where there is much greater runoff in the catchment headwaters and from hard surfaces and road drains in urban areas. To cope with this excess flow Combined Sewage Overflows (CSOs) take storm waters directly to the nearest watercourse. Storm flow conditions usually mean that any pollutants are quickly washed downstream and are greatly diluted. However, many urban sewer systems are now outdated and are long past coping with the waste output of a much larger population so the CSOs come into operation far more readily without needing storm conditions. Flow levels in the receiving watercourses are not sufficient to dilute or wash away any pollutants. In the Don catchment, as described earlier, there is an ongoing initiative to improve the sewer system.

Tucker and Evans (1997) report that an assessment of river quality (based on the nutrient status of the water) in Europe found that overall approximately 25% of river reaches are of poor or bad quality (see **Figure 2.14** re comparison of quality of European rivers).

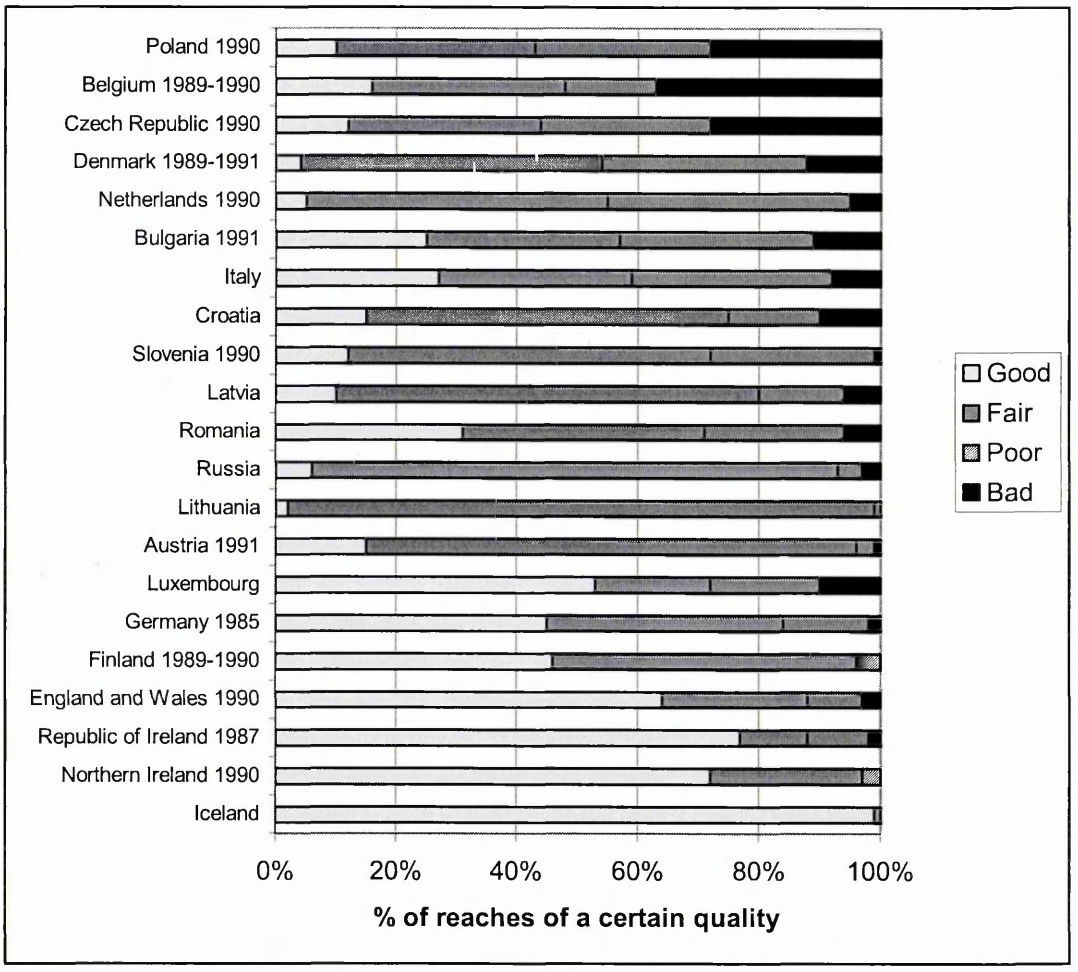


Figure 2.14: **The quality of European river reaches (adapted from the work of Stanners and Bourdeau, 1995, in Tucker and Evans, 1997).**

Good

River reaches with nutrient-poor water, low levels of organic matter; saturated with dissolved oxygen; rich invertebrate fauna; suitable spawning ground for salmonid fish.

Poor

River reaches with heavy organic pollution; oxygen concentration usually low; sediment locally anaerobic; occasional blooming of organisms insensitive to oxygen depletion; fish population small or nil; periodic fish kill.

Bad

River reaches with moderate organic pollution and nutrient content; good oxygen conditions; rich flora and fauna; large fish population.

Fair

River reaches with excessive organic pollution; prolonged periods of very low oxygen concentration or total deoxygenation; anaerobic sediment; severe toxic input; no fish.

The Environment Agency reported in 2002 that the worst polluters of the watercourses in England and Wales were agriculture and the water industry. A press report relating to these findings is shown in **Figure 2.15**.

THE INDEPENDENT
Thursday 25 July 2002

Water companies and farms singled out as Britain's worst polluters

BY MATTHEW BEARD

THE AGRICULTURE and water industries were named yesterday as the two chief culprits in a report detailing levels of environmental pollution in Britain last year.

The Environment Agency reported a gradual overall reduction in air and water pollution by industry but warned that the downward trend had been bucked by "unacceptable" incidents. Some of the biggest water companies, including Anglian Water Services, Thames Water, United Utilities Water and Yorkshire Water were responsible for 11 per cent of all pollution incidents, according to the report on business environmental performance in 2001. Last year the agency brought prosecutions against eight water companies, resulting in average fines of £38,000. United Utilities Water was the worst offender, incurring a total of £70,500 in fines for 12 offences.

In one of the worst individual cases, Dwr Cymru/Welsh Water was fined £3,500 and £19,836 costs after it was found guilty of killing tens of thousands of salmon and trout by polluting the River Teifi from a water treatment works near Pontrhydfendigaid.

Barbara Young, the agency's Chief Executive, said: "Most regulated emissions from industry continue to go down, and air and water quality continue to improve. But there is no room for complacency.

"The increase in the number of serious pollution incidents affecting water bucks an encouraging trend of improvement over the past decade.

"Contamination of water took many forms – noxious effluent, raw sewage, silt and oil – but it often had one single cause. Management failure."

The agriculture sector accounted for seven per cent of pollution incidents to air, land and water in 2001 and 12 per cent of the most serious cases.

Small farms escaped being mentioned in the report, which only scrutinises company performance. In the worst case a large farm in Tuttington, Norfolk, was fined £10,000 for polluting a tributary of the River Bure with diesel and failing to report the incident to the Environment Agency.

The report also sought to highlight increasing concern about pollution by "high street" companies, many of which are not directly regulated by the Environment Agency.

Tesco was fined a total of £37,518 after 197 of the store's abandoned trolleys were found in the Rivers Cam and Chelmer. The chain had resisted an environmentally friendly coin-operated trolley system which it has now implemented.

JJB Sports in Wigan was fined £14,000 for dumping wooden pallets, shoes and other JJB merchandise which were then burnt by vandals, polluting the air.

The report noted that most regulated air emissions went down in 2001.

Figure 2.15: Press report relating to 'Britain's worst polluters'.

In rural areas point source pollution outlets are rare but increasing. This is particularly the case where there has been intensification of livestock farming. Point sources of pollution occur at leaking silage clamps, overflowing slurry stores, dirty washing water from farmyards (Newson, 1992 [b]). Although the Don catchment watercourses are not badly affected in this way there may be opportunities to provide small treatment systems to negate the effects from such sources. These are often now designed as Sustainable Urban Drainage Systems (SUDS) which can incorporate a variety of techniques to reduce the quantity of runoff from a site, slow the velocity of runoff to allow settlement, filtering and infiltration, reducing the level of pollution caused by surface runoff.

The risk of leachate pollution from agriculture has increased as farming practices have intensified. The greater use of herbicides, fungicides and pesticides has also become an increasing concern over the last fifty years. Storage and disposal of large amounts of animal waste and the use of pesticides, herbicides and fertilizer could present significant risks to river quality. The National Audit Office have reported that in 1993 there were 2,680 reported pollution incidents attributable to farms (National Rivers Authority, online undated [a]). The Department for the Environment, Food and Rural Affairs [DEFRA] (2002) state that diffuse pollution, by its very nature, is hard to quantify, and results from agricultural leaching, urban runoff and from transport. It is also very difficult to trace diffuse pollution back to its source. DEFRA clearly state that all agricultural sectors have the potential to cause local environmental harm if not well managed. They identify the biggest risks occurring on arable land where there is nutrient enrichment and pesticide loss, and from dairy and other livestock systems where the density of animals exceeds the capacity of the land. The latter is not a major problem for the Don catchment as there is little livestock farming adjacent to the river system but arable farming could be a problem area, particularly in the lower lying lands north east of Doncaster. Interestingly, they also present an estimate of the total external environmental costs of agriculture in the UK as being between £141 - £300 million per year at 1996 prices. In a national context, Howe and White (2002) quoting the Environment Agency (2001) report that the UK agricultural sector is the largest source of water pollution, accounting for 27% of serious and significant pollution incidents. Norris (2002) estimates that 90,000 tonnes of phosphorus and 1,200,000 tonnes of nitrogen are used on UK farmland as fertiliser each year. The potential for leaching into water courses is immense, but constructed wetland filter systems can control diffuse pollution (Mitsch, 1994).

Despite the Don catchment having had an ongoing reputation of heavily polluted waters since the rapid industrial expansion of the nineteenth century, and the rivers in the catchment being classed as some of the most grossly polluted in Europe in the 1970s, there has been significant

improvement in the last two decades. This is highlighted in the DEFRA, 2001 review of national and regional *'quality of life'* indicators. Indicator H12 (River Water Quality) shows comparative figures for chemical and biological quality between 1990 and 2000. In the region of Yorkshire and the Humber the increases are more pronounced than national averages with chemical quality increasing by 14% points to 90% and biological quality increasing by 9% points to 88% (Anon., 2002 [c]). **Figure 2.16** shows the length of river and canal classifications for water quality in the Don catchment in 1996.

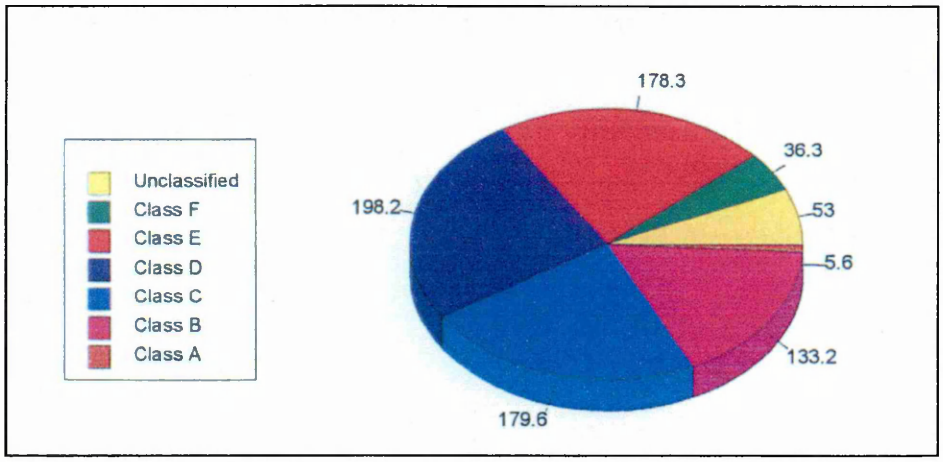


Figure 2.16: **Length of river and canal classifications for water quality in the Don catchment in 1996.** (Source: Environment Agency, 1997).

One of the major impacts of pollution to certain rivers in the Don catchment has developed as the result of the extensive coal mining activity in the area until very recently. Water inundates most mines in this country when there is not constant pumping to remove it. Eventually old and abandoned collieries typically discharge minewater into watercourses. The chemical composition of such discharges is variable but many contain reduced iron minerals which, on contact with air, oxidise and precipitate out ferruginous deposits typically seen as bright orange deposits on river beds (Lunn, 2000). The first major recognised pollution problem from abandoned mines was at Wheal Jane tin mine in Cornwall which demonstrated a forthcoming problem for all mining areas in the country. Here, a pilot treatment project alone cost over £8 million.

Some of the most serious of the country's minewater discharges occur in the Don catchment (Environment Agency, 1996). Of particular note are Sheephouse Wood and Bullhouse Colliery on the upper reaches of the Rivers Don and Little Don respectively. A scheme to ameliorate this is described in *Chapter 4*.

2.4 Wetland engineering and flood issues.

Ward, Holmes and Jose (1994) and English Nature (2001) suggest that engineering works on rivers with the aim of reducing flooding or improving land drainage (for agricultural improvement or other development) can have serious adverse impacts, which can degrade both the ecological value of the main channel and its associated flood plain habitats. Drainage of agricultural land has become an increasing trend over the last few centuries but has shown an even greater rise as membership of the European Union has encouraged farmers and land owners to bring marginal land into agricultural production to obtain the subsidies and livestock headage payments that were available in the 1970s. **Figure 2.17** shows this rise in the amount of land being drained each year.

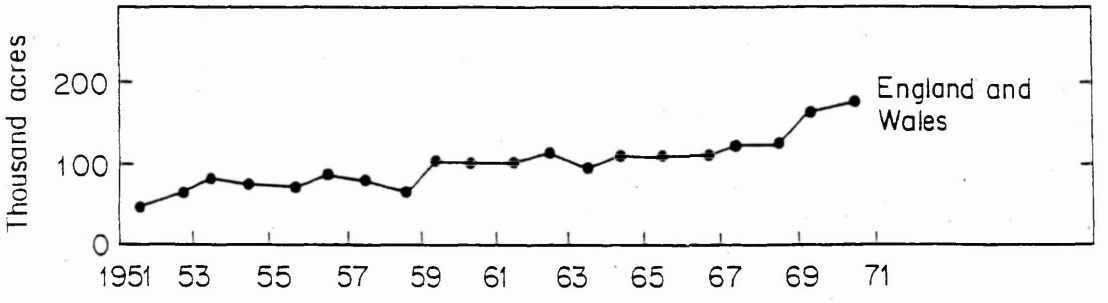


Figure 2.17: Rates of agricultural drainage in England and Wales 1951 - 71. (Green, 1973).

Figure 2.18 is a cartoon highlighting the contentious debate about drainage in the late twentieth century.

Figure 2.18: **Cartoon describing the contentious debate about drainage of agricultural land in the late twentieth century.** (Source: *ECOS*, **Vol. 12**, No. 13.).

Dugan (1988) quotes substantial evidence of the role of wetlands in regulating floods and improving water quality. Salathe (2000) and Mason (1996 [a]) suggest that the draining of farmland, the straightening of river channels and their separation from their flood plains by embankments has increased flood risks downstream. Debate in the popular media is still being conducted as to whether the major floods in the United Kingdom and mainland Europe in recent years, as a result of intensive precipitation events (such as those shown in **Figures 2.19 - 2.23**) are as a result of such landform changes or whether they are a result of climate change. But there are significant indications of apparent changes in weather patterns and this does suggest that the substantial engineered flood containment areas (such as that shown on the River Rother in **Figure 2.24**) may no longer be able to cope.

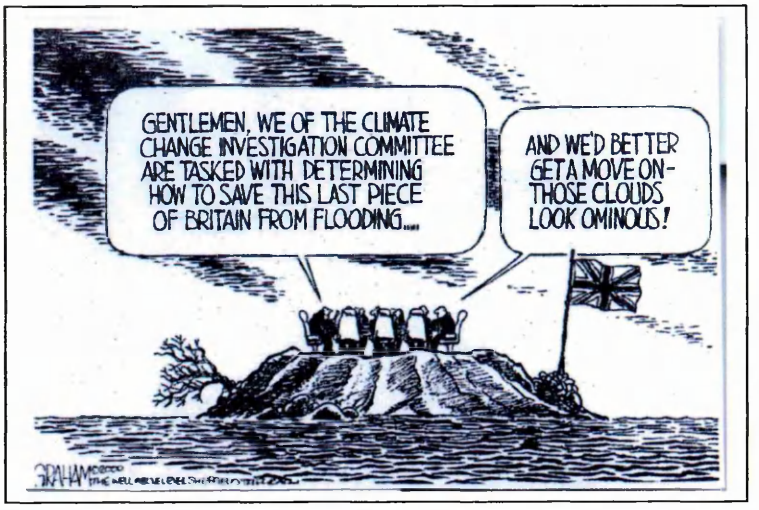
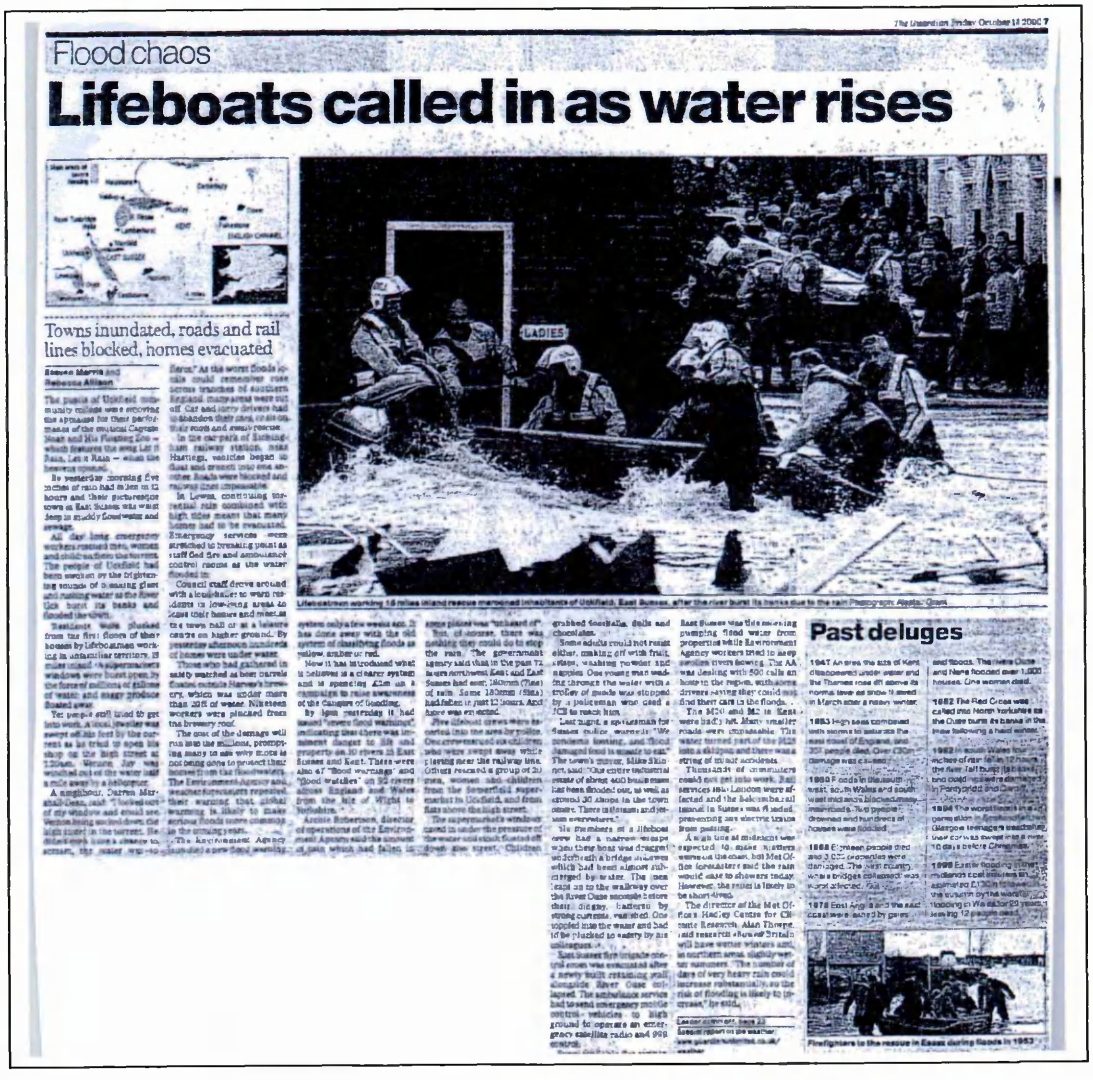


Figure 2.19: **Cartoon linking climate change to severe floods.**
(Source: Graham, Sheffield Telegraph newspaper, 2000).

Figure 2.20: **Flooding in York, 2000.** (Source: Lucy George).

Figure 2.21: **Flooded River Don near Meadowhall, Sheffield, 2000.** (Source: Ric Bingham).

Figure 2.22: **Flooding on the River Rother at Catcliffe, Rotherham, 2000.**
(Source: Author).



Flood chaos

Lifeboats called in as water rises

Towns inundated, roads and rail lines blocked, homes evacuated

Lifeboatmen working 16 miles inland rescue marooned inhabitants of Uckfield, East Sussex, after the river burst its banks due to the rain Photograph: Alastair Grant

Past deluges

1947 An area the size of Kent disappeared under water and the Thames rose 6ft above its normal level as snow it stored in March met a heavy winter

1953 High seas combined with storms to inundate the east coast of England, and 307 people died. Over £30m damage was caused

1960 Floods in the south west, South Wales and south west and west blocked many main roads. Two people drowned and hundreds of homes were flooded

1968 Fifteen people died and 3,000 properties were damaged. The west country, where a bridge collapsed, was worst affected

1978 East Anglia and the east coast were swept by gales and floods. The rivers Ouse and Nene flooded over 1,000 houses. One woman died

1982 The Red Cross was called into North Yorkshire as the Ouse burst its banks in the snow following a heavy winter

1993 South Wales four inches of rain fell in 12 hours, the river fell burst its banks and road was submerged in Pontypridd and Cardiff

1994 The worst rainfall in a generation in Scotland caused Glasgow teenager's death after car was swept into a river 10 days before Christmas

1998 Easter flooding started midlands coal industries an estimated £130m following the collapse of the railway bridge flooding in the east for 20 years. It was the 12 people died

Firefighters to the rescue in Essex during floods in 1953

Figure 2.23: **Example of press coverage of the Autumn floods, 2000.**
(Source: Morris and Allison, Guardian newspaper, Friday 13 October, 2000)

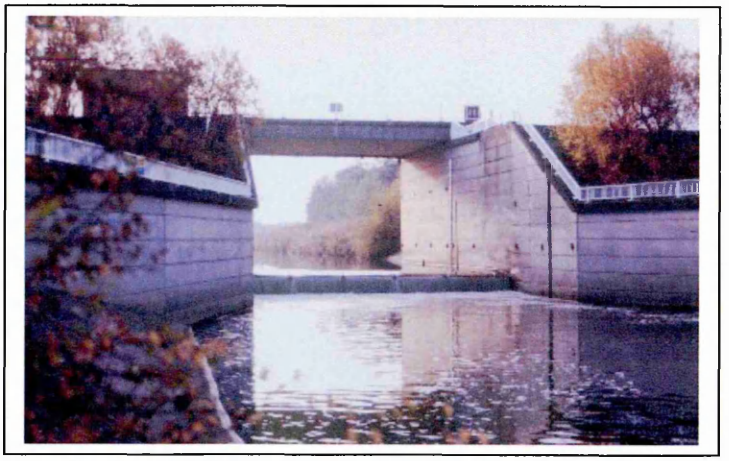


Figure 2.24: Floodgate on the River Rother - part of the Country Park flood containment system. (Source: Author).

This trend in weather patterns also puts under threat much of the recent flood plain development that has occurred in times when planning decisions seem to have had little foresight. To support this view Sutherland (2000) states that it is becoming increasingly accepted that the costs to individuals, organisations, governments and insurance companies from building on flood plains are unacceptable and conservation of natural processes is better value. The recent floods have also resulted in a reaction against development on flood plains as outlined in proposals requiring builders and developers to pay for any required flood defences alongside greater reluctance by planning authorities to grant permissions in such areas (see **Figure 2.25**).

Builders will be forced to pay for flood defences

BUILDERS WILL have to pay to defend new homes from flooding under rules being drawn up by ministers in the wake of last week's flooding in the south-east.

The rules, to be published before Christmas, will also lay down that there should be no new houses in areas at serious risk of inundation and will require local authorities to recognise the important role of undisturbed flood-plains and wetlands as a form of flood defence.

The Environment Agency, which is in charge of flood control in England and Wales, wants ministers to go even further and ban all building on the flood-plains that cover one-tenth of the country, except in exceptional circumstances.

The new rules are designed to end a situation where house-

BY GEOFFREY LEAN and AMY ANDERSON

builders have built widely on cheap flat land that is prone to flooding, despite official advice not to do so.

Experts estimate that half the house building since the Second World War has been imprudently sited on areas naturally prone to flooding. The Environment Agency objects to 30,000 planning applications in flood-prone areas every year, but one in five of them are nevertheless approved by local authorities.

Scores of people remained homeless yesterday after parts of Sussex and Kent suffered their worst flooding in 40 years.

Experts are predicting that the floods will leave a repair bill of £4bn. River levels in some areas were the highest ever recorded, the Environment Agency said.

Details of the new building rules are still under discussion, but the latest confidential draft requires councils to take into account "the susceptibility of land to flooding" in deciding whether to give planning permission and lays down that land which cannot be defended against inundation should not be developed.

The rules emphasise the importance of flood-plains and wetlands, which act as vital safety valves for floodwater, and say that builders must pay to provide flood defences, which are at present financed from the public purse.

They will also lay down that all new developments, wherever they are, must be designed to minimise the risk of rainwater pouring off them and causing floods downstream.

The rules are expected to be tightened even further after last week's floods, and ministers are ready to enforce them by calling in and deciding on planning applications that violate them. But the Environment Agency wants them to go further and ban all building on flood-plains except where there are compelling reasons for it.

"It is crazy to put more people at risk," says Geoff Mance, director of water management at the agency. "We can never afford to build defences that will give 100 per cent protection. There will always be a flood that goes over the top."

The agency has drawn up detailed maps of the eight to nine per cent of the country most at risk of flooding, and it wants the Government to use these to define the areas where building should, in effect, be banned.

Mr Mance believes that the Government's plans are "still biased in favour of the developers".

Yesterday, water levels were still too high to begin pumping in many areas, including Yalding, Kent, where homes and shops were inundated after the River Medway burst its banks. Although severe flood warnings are still in force for the Medway, conditions are expected to improve if the weather remains dry as forecast. Nearby Maidstone remains on severe flood alert.

In Lewes, East Sussex, one of the hardest hit areas, the Environment Agency has begun pumping contaminated water into tankers before clearing homes and businesses in the low-lying areas of town.

Figure 2.25: Newspaper article outlining speculation on government responses to recent flooding. (Source: Lean and Anderson, Guardian newspaper, 16 October, 2000).

The service that flood plains provide as an alternative method of flood defence is now being recognised. Although flooding of rivers has always been a naturally occurring event there has been an observable increase in the incidence of serious floods in England and Wales over the past decade. This has focussed attention on the use and management of flood plains and suggested a need for a more focused strategic approach to flood management. Howe and White (2002) quote the Environment Agency (2001) in stating that the damage caused by the UK floods in autumn 2000 cost in the region of £1 billion. English Nature (2002) highlight the historical degradation of flood plain wetlands, mainly through drainage for agriculture and in urban development. It is now becoming recognised that wetlands in flood plains act as 'sponges' to retain water throughout the flood event (RSPB, online, undated [b]; Maltby and Blackwell, 1999; Green, 1996). This highlights the importance of retaining the upland wetlands of a catchment in an undrained condition and significantly reduces the need for expensive engineered structures.

In economic terms washland flood prevention is very significant. The Ramsar Bureau report that the estimated value of 3,800 hectares of wetlands along part of the main stream of the Charles River in the United States is US$17 million per year. This is based on the estimated cost of flood damage that would result if they were drained. English Nature (2001) suggest that flood plains can be managed in an integrated way to reduce risk to people and property at the same time as providing additional habitat and other recreational and productive uses taking a catchment-based approach to managing flood risk in a framework suggested within the Water Framework Directive. English Nature also quote John Prescott, the Deputy Prime Minister, on a visit to view newly developed flood defences in Holland as saying;

"In England, when we see flooded fields, we see it as a sign of failure. In Holland it is a feature of a working water management system".

But it cannot be ignored that flood defence in the short term will be extremely costly. **Figure 2.26** highlights the debate in this area immediately following the autumn 2000 floods.

6 The Guardian Monday November 6 2000

Weather chaos

Prescott's £51m to beat floods 'a drop in the ocean'

State aid
Adequate defences could cost billions

John Vidal

John Prescott's offer of £51m over four years to prevent the sort of floods seen in the past month is a drop in the ocean of what may be needed, say the environment agency and green organisations.

Geoff Spence, head of water management at the environment agency, yesterday welcomed the extra one-off cash payment but said he would be "amazed" if a review of Britain's inland flood defences did not reveal the need for far more money to be spent.

"It will certainly be far more than £51m," said Mr Spence. The agency argued for £100m a year in last year's spending review but was given £30m extra, despite conservative estimates from the Department of the Environment that global warming would require an extra £4.5bn to be spent on flood defences in the next 50 years.

Only £2m (4%) of the new money promised by the government at the weekend can be spent in the next 12 months. Most is expected to go on "running repairs" to the failing inland defence systems and to accelerate existing studies of what work needs to be done to protect towns such as Shrewsbury, Bewdley, Lewes, York, Gloucester and Uckfield, which have repeatedly been hit in the past few years.

Yesterday, the new money was criticised for being too little too late by green groups and communities affected by some of the worst flooding on record. "The sums Mr Prescott is talking about are finger-in-the-dyke stuff. We'll never keep climate change at bay by spending a few million. It will cost billions, the problems are that serious," said Charles Secrett, director of Friends of the Earth.

The priority, said the environment agency, would be to repair defences which have been damaged or destroyed in the past 10 days. The agency will begin a review of inland defences when the floods have gone, but this is not expected to be published until February.

One problem the authorities face is that even relatively small new defences can take up to four years to evaluate, design and build.

There is no simple way of defending all towns and villages. No one is in favour of building high flood walls around all vulnerable places. Experience abroad has shown that investments of this kind which may invoive huge earthworks, raising river banks, building sluices and canalising rivers to divert water, often fail and lead to problems elsewhere.

The reality is that if, as expected, climate change kicks in with more frequent extreme weather, government, the business community and individuals must be prepared to spend billions of extra pounds a year unless far greater emphasis is given to keeping the water on the land, and preventing it from reaching the rivers too quickly.

The quandary is that to do anything serious will cost billions, but to do nothing may cost much more. A recent EU report on the adaptations required for climate change in Europe noted the increasing pressure of floods and extreme weather on water resources, agriculture, transport, health, and coastal zones.

So far Britain has seen little damage compared to what is forecast to happen.

The Association of British Insurers estimates it could cost at least £10bn in insurance losses if the Thames catchment region were massively flooded. A prolonged storm over the upper half of the river Trent and Severn catchments, it said, could cost about £5bn.

"It's vital that flood defences are adequate. It could take very high investment to bring internal defences up to scratch. Coastal defences, too, are inadequate in certain areas," said an ABI spokesman yesterday.

Figure 2.26: Press article about the cost of flood protection.

Many settlements have developed around river crossing points where transport routes converged. As a consequence the flood plains and channels of many major rivers became very restricted in urban areas. This is particularly so as the River Don passes through Sheffield. These restricted channels could not cope with large storm flows and serious flooding of developed areas occurred. The Environment Agency accept that only recently have they begun to value the natural function of flood plains and recognise that it can be more cost effective to work with nature rather than to fight it.

In their review of the Autumn 2000 floods the Environment Agency (2001) state that an estimated 1.85 million homes, 185,000 commercial properties and approximately 5 million people are now at risk from flooding. They also report that increasingly over the previous five years there has been a significant increase in the amount of development proposed in flood risk areas. English Nature (2001) compute the fact that, given there are 1.3 million households at risk from flooding, this equates approximately, to over £100 million per annum.

With increasing concern about potential climate change with its expected increase in both frequency and extent of flooding there appears to be an urgency about strategic planning for this risk. The Environment Agency acknowledge that the implementation of Planning Policy Guidance (PPG) 25 relating to Development and Flood Risk has been a major step forward with flood plain planning. This guidance policy suggests that natural flooding events are exacerbated by the factors shown in **Figure 2.27**.

Factors which add to the problems of natural flooding events:

* growth of built development in catchments alongside other changes in land use which increases the rate and volume of runoff;
* sediment movement can change river cross-sections and affect flood levels;
* lack of maintenance of flood defence systems, watercourses, culverts and road gullies, particularly where this leads to blockages;
* canalization/modification/diversion of rivers and watercourses, increase the flow rate and decrease the time taken for water to travel within a catchment;
* building of structures (e.g. embankments) which restrict flows over historical flood plains and creates additional flood risk upstream and downstream.

Figure 2.27: **Factors which add to the problems of natural flooding events.**
(Source: Environment Agency, 2001).

The consultation document for PPG 25 (2001) suggests that engineered flood defences may not be suitable in the long term and that a sustainable approach will involve avoiding additional development in some areas. It also requires that planning decisions address the issues shown in **Figure 2.28**.

Planning decision requirements in relation to PPG 25 should:

* apply the precautionary principle to the issue of flood risk, using a risk-based search sequence to avoid such risk where possible and avoiding it elsewhere;
* recognise the importance of functional flood plains, where water flows or is held at times of flood, and avoid inappropriate development on undeveloped and undefended flood plains;
* recognise that the consideration of flood risk and its management needs to be applied on a whole catchment basis and not be restricted to flood plains.

Figure 2.28: **Requirements to be considered for planning decisions in relation to PPG25.** (Source: DETR, 2001).

In England and Wales the Environment Agency is strategically approaching flood defence and management through the development of Catchment Flood Management Plans (CFMPs) which deliver a broad-brush assessment of the risks, opportunities and constraints (including areas of uncertainty) associated with flood management policy. Underlying this strategic tier is the formulation of Strategy Plans for individual rivers within a catchment to apply policies at a local level (Environment Agency, 2002). In the Don catchment the Environment Agency are aware of a particular risk from flooding because of the rapid response of the rivers to rainfall, heavy urbanisation (and thus rapid runoff) in many areas, extensive low-lying areas, and the tidal influence downstream of Doncaster. They identify the issues shown in **Figure 2.29** as of significance.

Risk of Flooding The risk of flooding at some locations is unacceptably high because they are unprotected or are protected by defences which are either below standard or ageing.
Washland areas Washland areas might be more effectively used for storage of flood waters and as sites for nature conservation.
Flood forecasting and warning The flood forecasting and warning service could be further improved.
Management of abstractions, reservoirs and water levels The health and diversity of wetland and river ecology including fisheries is severely affected by the management of abstractions, releases from reservoirs, and water levels.
Groundwater resources Groundwater resources require careful management to ensure long term sustainability.

Figure 2.29: **Issues relating to flooding in the Don catchment.** (Source: Environment Agency, 1997).

In 1947 a disastrous flood near Doncaster, emphasised the need to improve the level of flood protection. A flood relief route was provided to limit the extent of the flooding but a longer term measure was also needed. To facilitate this the River Don washland scheme increased the natural storage of the flood plain upstream. This involved the formation of a series of embanked compartments constructed in the valley between Doncaster and Rotherham and on the tributaries of the Dearne and Rother in conjunction with the flow regulator gates. These could be raised in times of flood to artificially raise the water level above natural flood levels and so retard flood flows in these tributaries to reduce the peak flow in the Don itself (National Rivers Authority, undated). In a summary (**Figure 2.30**) of a flood defence programme of works for the Don catchment the estimated costs show the relatively huge funding resources required.

Fluvial Defences:		Estimated Cost £
Stainforth (River Don)	In progress -1998/99	£100 k
Arksey (River Don)	2002/03	£500 k
Ea Beck	In progress - 2001/02	£3530 k
Sheffield (River Don)	2006/07	£300 k
Blackburn Brook	2004/05 - 2005/06	£600 k
Darton (River Dearne)	2005/06	£300 k
Chesterfield (River Rother)	2007/08	£300 k
Dronfield (River Drone)	In progress - 2000/01	£1312 k
Tidal Defences:		
Old Goole	2004/05	£850 k
Old Goole to Dutch River Bridge	2004/05 - 2006/07	£1700 k
Dutch River Bridge to Rawcliffe Bridge	2006/07 - 2007/08	£2000 k

Figure 2.30: **Summary flood defence programme of works for the Don catchment.** (Source: Environment Agency, 1998 [b])

Increasingly, the value of wetlands for multi-purpose use is becoming more appreciated and it is significant that wetland habitats are being singled out for special national and international treatment (David, 1988). Norris (2002) in citing from the Water Framework Directive of the European Union suggests that water is not a commercial product, but rather a heritage which must be protected and defended. In the United States wetlands are considered to be part of the waters of the country and are protected under the Clean Water Act (1998). This requires those

proposing to dredge/fill material into such waters to obtain a permit from the Army Corps of Engineers to guidelines provided by the Environmental Protection Agency (Hirsch, 1988). This investigation of wetlands has demonstrated their importance but also described their historical abuse. In view of their necessary functional benefits this suggests a clear need to enhance, rehabilitate and create wetland sites to mitigate for losses. *Chapter 3* investigates how this can be achieved.

2.5 Summary of findings.

The findings of this chapter in relation to wetland functions and processes follows a time-line of differing usage and perception. A historical view of wetlands paints a picture of destruction, manipulation and decline through drainage for agriculture, industrialisation, increasing use as a medium for pollution, increasing use for transport, and increasing control of the flow of water through engineering. This could be said to represent a functional and utilitarian viewpoint.

In the post-industrial scenario there is a picture of renewal through increasing recognition of the potential for tourism, increasing recreational use, a changing attitude to water and wetlands in respect of aesthetics and healthy living, and their increasing use as key features of development and regeneration areas. This could be said to represent a sensual and aesthetic viewpoint.

The study shows a clear dichotomy of how water and wetlands are perceived with both love (for their aesthetics, recreational opportunities, 'clean' image and through a clearer recognition of their vital functions) and fear (of disease, danger and pollution).

Chapter 3 investigates how wetland ecosystems and functions can be enhanced and developed.

3.0 RESTORATION, REHABILITATION OR HABITAT CREATION AS REGENERATION TOOLS – AN OVERVIEW OF THE LITERATURE.

3.1 The need for mitigation measures.

The history of industrial and agricultural change in the Don valley and those of its tributaries leaves a considerable opportunity to provide wetland habitats that act as a catalyst and backcloth to social and economic regeneration if the contention of this study is realized.

In the late nineteenth century, George Perkins Marsh, an American diplomat and early conservationist, proposed the concept that nature in the absence of human intervention is in a state of balance that changes little over long periods of time (Weddell, 2002). Despite the fact that this concept ignores humanity as an integral part of an ecosystem, the viewpoint has significantly influenced conservation strategy and policy formulation for many years. Weddell suggests that as a result of this concept, resource managers (whether for conservation or utilitarian use) are faced with two alternatives; either to leave the site alone and protect it, or to manipulate and 'improve' it. In a strategic climate where protection and preservation are paramount, humanity is excluded and this has resulted in the early creation of nature reserves that were ring-fenced with only the 'elite' scientists gaining access for observation and research. Particularly with the advent of the growth of urban wildlife groups a view was taken that such elite protection policies could not operate where humanity and wildlife interacted. There was a huge need for an interface between the two which provided some protection for wildlife and its habitats alongside social benefits such as recreation, education, health and well-being. Kendle and Forbes (1997) suggest that the re-introduction of 'wild' areas to the urban environment is often a means to compensate in part for the disappearance of nature from people's everyday experience.

There has also been recognition of the need for more sustainable agricultural practice following the widespread destruction of habitat during the European drive for maximum agricultural production, resulting in the reduction of subsidies for intensive production and the availability of grant aid for agri-environment schemes. Weddell (2002) promotes the sustainable ecosystem approach which seeks to integrate resource preservation and use. The approach strives to maintain ecosystem structure and function as a means of maintaining both biodiversity and productive capacity. Because natural systems are often in a state of flux and that people are an integral part of that flux, a cycle of development, decline, dereliction and regeneration is an integral part of the human condition, and the environment.

Stevenson and Newson (1992) suggest that damaged ecosystems require assistance to alter conditions to benefit the redevelopment of pre-disturbance conditions. In some cases they promulgate that some ecosystems will have been irretrievably transformed by human action with little prospect of natural recovery.

Moser (2000) proposes that the traditional perspective of wetlands being wastelands, and consequently the view that these should be made more productive by draining and in-filling, has been overturned in Europe over the last two decades. People have become far more aware of the important ecological and hydrological functions that wetlands perform, and the wide range of products and services that they provide. Legislation at all levels has provided increased protection for wetlands to the extent that there is some evidence of a reduction in the rate of loss and to continue this process, help is needed through rehabilitation of degraded wetlands and restoration of some of those that have been lost.

3.2 Definitions - restoration or rehabilitation?

Many different words are used to describe the diversity of interventions that provide or enhance habitats. These are often interpreted or misused in a variety of ways. For instance, the terms 'restoration' and 'habitat creation' are seen as completely different operations in the UK and most of continental Europe but in the United States the term 'restoration' incorporates both. It is useful to see how some of this terminology has been defined and adapted.

The Society for Ecological Restoration (SER) has defined ecological restoration as, *"the process of repairing damage done by humans to the diversity and dynamics of indigenous ecosystems"*. Their objectives are to, *"upgrade the quality of existing natural areas and to augment the planetary inventory of natural areas"*. Debates take place within the organisation as to how a return to ideal pre-existing conditions can take place and as to what exactly are the ideal conditions. Questions are raised about whether the goal should be to restore to the stage before any human impact or to restore to some assumed stage which would be how some of these communities would have developed had no degradation taken place (Kendle and Forbes, 1997, p.180 - 181 and Streever, 1999).

The U.S. Environmental Protection Agency quote the U.S. National Research Council definition of restoration as the:

"... return of an ecosystem to a close approximation of its condition prior to disturbance .... It means the re-establishment of pre-disturbance aquatic functions and related physical, chemical and biological characteristics. Restoration is a holistic process not achieved through the

isolated manipulation of individual elements. Merely recreating a form without the functions, or the functions in an artificial configuration bearing little resemblance to a natural form, does not constitute restoration. The objective is to emulate a natural, self-regulating system that is integrated ecologically with the landscape in which it occurs" (Anon., online, undated [f]).

Bradshaw and Chadwick (1980) and Petts (1998) support this by stating that the aim of reclamation must be to restore the original qualities of the environment to a normally functioning ecosystem. Petts also states that restoration should focus on processes and functions rather than structures and that the aim should be to restore 'ecological integrity'. However, Fowler, Jose and Smith (1998) suggest that rehabilitation to a partially natural state is more realistic. The term 'restoration' seems to attract varied and often conflicting definitions.

Kendle and Forbes (1997, p.176) define 'rehabilitation' as, *"a partial re-establishment through human intervention of the original biota and/or ecosystem"*. This is supported by Pygott (1995) who suggests that the only course for practical professionals is to use their ecological expertise to select elements from their knowledge of the pre-disturbance state for attempted re-creation. **Figure 3.1** shows a rehabilitation scheme implemented on the River Skerne by the River Restoration Project.

Figure 3.1: **River Skerne rehabilitation project.** (Source: Airfotos/Northumbrian Water).

The US Department of the Interior (1994, p.39) question the ability of restoration projects to be 'successful' and state that:

".....replicating nature in all its variations and complexities is not just difficult, it is probably impossible. Most natural wetlands are the result of lengthy geologic and hydrologic processes, and require more or less continuous supplies of water, a balanced regime of sedimentation and erosion, and periodic events to interrupt successional sequences".

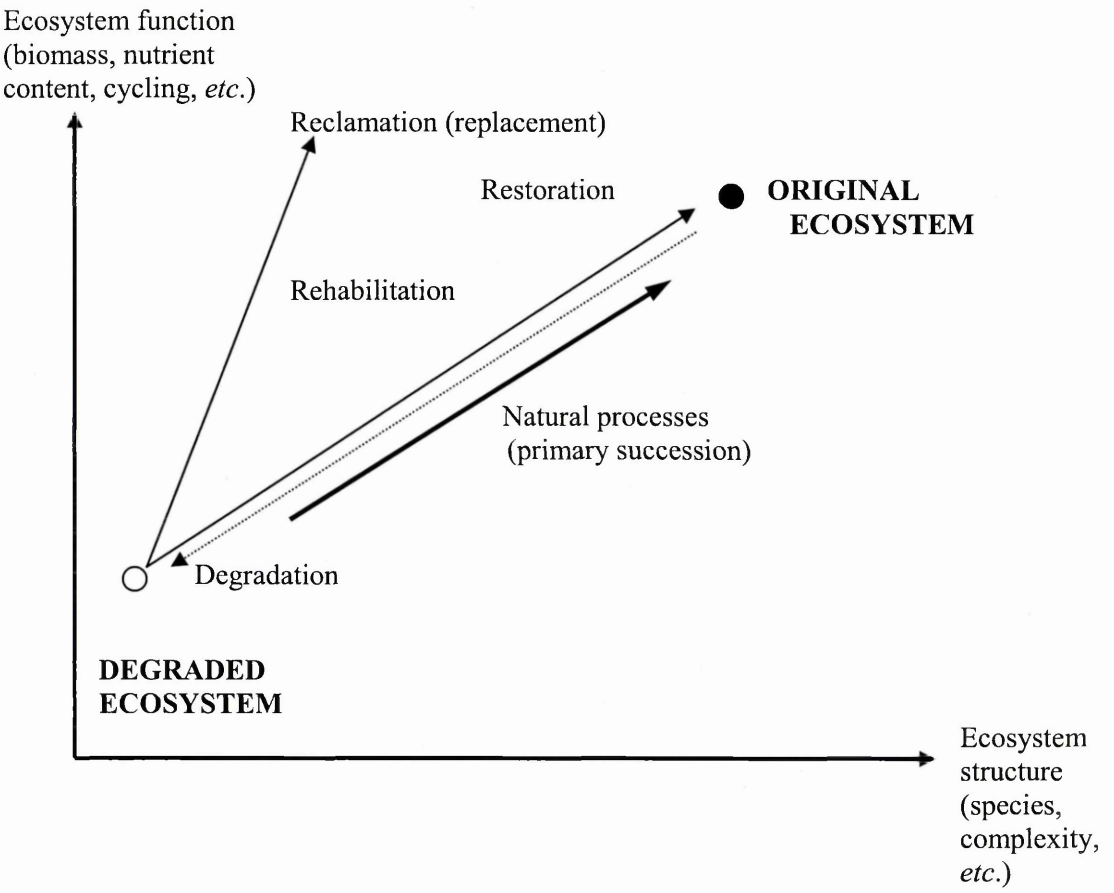
The US Environmental Protection Agency (Anon., online, undated [f]) suggests that, if sustainable wetland management is to be achieved, rehabilitation must mitigate for and restore the hydrological link between rivers and their flood plains. It must also provide benefits for a range of biodiversity as well as bringing about wider economic and social benefits in terms of reduced flooding, increased water resource security and improved recreational value. Suggested meanings for 'mitigation' are shown in **Figure 3.2**.

Meanings of 'mitigation':

* avoiding the impact altogether by not taking a certain action or parts of an action;
* minimizing impacts by limiting the degree or magnitude of the action and its implication;
* rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
* reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;
* compensating for the impact by replacing or providing substitute resources or environments.

Figure 3.2: **Meanings of 'mitigation'.** (Source: U.S. Department of the Interior, 1994).

One problem with this definition of mitigation is that it does not rank its different components suggesting the possibility of developers choosing which elements best suit them. Increasingly the *'precautionary principle'* is being considered within the United Kingdom. Bradshaw (1997) makes it clear that the end point must always be clear when initiating a project. He proposes that project developers must be clear as to the aim of the project - whether it is full restoration, restoration of only certain attributes, rehabilitation or reclamation. **Figure 3.3** overleaf provides useful guidelines.



NB. Mitigation = any restoration, rehabilitation or reclamation, even of a different ecosystem, to moderate the effects of a degrading action.

Figure 3.3: **The different options for the improvement of a degraded ecosystem expressed in terms of the two major characteristics of structure and function.**
(Source: Bradshaw, 1997).

The Ramsar Convention Scientific and Technical Review Panel's Expert Working Group on Wetland Restoration has proposed a series of principles on which restoration might be considered (Anon., online, undated [g]). These are shown in **Figure 3.4** overleaf.

Principles on which restoration might be considered:

* preservation of existing high-quality habitat should take precedence over restoration;
* individual, relatively small restoration projects targeting a single wetland can be valuable. However, whenever possible, the minimum acceptable scale for wetland restoration planning should be at the watershed scale. Wetland restoration planning should not ignore upland habitats;
* restoration requires long-term stewardship;
* wetland restoration should be an open process that involves local community stakeholders;
* restoration projects should take into account the possibilities of undesirable, off-site impacts such as an increase in insect numbers or unwanted flooding;
* the principles of adaptive management should be applied to restoration projects - this allows for progressive modifications to cope with unforeseen developments or new opportunities;
* a clear understanding of goals, objectives and performance standards is a critical part of restoration projects.

Figure 3.4: **Principles on which restoration might be considered.**
(Source: Anon., online, undated [g]).

Sutherland (2000) compares the setting of conservation priorities for sites being considered for rehabilitation to the triage system of assessing patients in hospital Accident and Emergency Departments. He suggests that sites can be placed in three categories:

* having 'wounds' so severe that the nature conservation interest of the site is unlikely to survive, even with treatment;
* not requiring immediate treatment;
* having serious, but treatable damage, and therefore given top priority.

Consequently category 1 would lend itself to *habitat creation* projects. Action in category 2 would suggest *re-establishment, rehabilitation* or, perhaps more appropriately, *habitat management.* Action in category 3 is probably for *restoration.*

3.3 Habitat creation.

Habitat creation needs to be separated from habitat restoration. If a site is already occupied by semi-natural vegetation with a complex structure or high species diversity, habitat creation is not appropriate (Gilbert and Anderson, 1998). Habitat creation is never a substitute for natural colonisation and succession because it fails to achieve the crucial indicators of naturalness, continuity and complexity. Where there is a straight choice between preserving or re-creating a valuable habitat, preserving it will always be the ecologically preferred option.

But Gilbert and Anderson (1998) also suggest that habitat creation, including wetland creation, still has an enormous role to play in areas where the natural environment has already been extensively damaged. It is also a technique that is extremely desirable as part of land reclamation schemes. Used strategically, habitat creation can help to buffer and link the increasingly fragmented, isolated, and diminishing habitat patches of high value that still remain. Scale is not an issue as habitat creation schemes can range from the provision of a small school wildlife pond to major reclamation schemes. But as the scale increases so too does the cost, particularly in reclamation schemes on contaminated or unstable land. Funding for these schemes can be difficult to find. **Figures 3.5 – 3.8** show elements of the implementation of a large habitat creation scheme at Blackburn Meadows nature reserve adjacent to the River Don in Sheffield (one of the research project's case studies).

Figure 3.5: **Constructing the new lake at Blackburn Meadows nature reserve.**
(Source: Ric Bingham).

Figure 3.6: **Lining the new lake at Blackburn Meadows nature reserve.**
(Source: Author).

Figure 3.7: **Initial fill for the new lake at Blackburn Meadows nature reserve.**
(Source: Author).

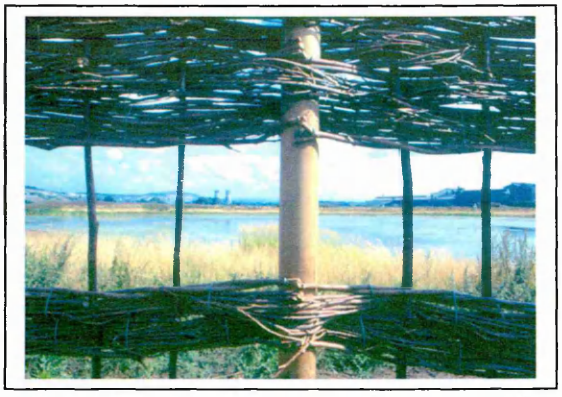


Figure 3.8: **Maturing lake habitat at Blackburn Meadows nature reserve through a wattle viewing screen.**
(Source: Unlnown).

Existing semi-natural habitats that are of high nature conservation value will have had stable management and conditions for a long period of time. They support species which require this stability. Specialist species will have adapted to niche conditions where this is little competition. Some species will readily be able to colonise new sites but these tend to be the commoner species which are able to survive in a range of habitat types and conditions. It is important to remember that habitats and the species that use them can be extremely complicated ecosystems with many inter-relationships of fauna and flora.

Baines (1992) differentiated between two types of habitat creation - 'political' and 'ecological'. 'Political' schemes occur mainly in urban areas where habitat destruction has been most pronounced and where there is a great need to make nature accessible to people in their everyday environment and to foster a concern for the wider countryside. Access to nature conservation sites has also been found to enhance people's sense of well-being and even to increase their ability to overcome illness. Such sites can also be used by educational establishments for education and awareness-raising without putting excessive pressure on habitats in the wider countryside.

Adams (1996) argues that new land use created through industrial change should encourage new landscapes and habitats of value that become valued by people as something to be engaged with and not treated as a mere commodity to be bought, sold or transformed as profit dictates.

'Ecological' habitat creation aims to duplicate as closely as possible existing natural and semi-natural habitats. They will be sited close to valuable existing habitats such that natural colonisation can occur. Their function is nature conservation, either by extending the existing area of habitat or acting as a buffer zone between unfavourable land uses and existing ecosystems. For example, there is currently strong promotion of buffer zones to be created between agricultural fields (which have been fertilised and/or treated with herbicides or pesticides) and water courses into which these substances might leach. Kendle and Forbes (1997) suggest that it is worth remembering that sometimes increasing biodiversity is very simple. For example, felling a patch of trees in a large woodland will increase the range of species that are found. They tell us that habitat creation is easy; the professional skill comes from deciding what type of habitat is most valuable, appropriate, likely to survive and to make a contribution in the long term.

3.4 Summary of findings.

In relation to wetland perception, functions and processes industrial decline and changes in agricultural practices (described in later chapters) have resulted in significant amounts of land being freed for other purposes. The river Don catchment (described in detail in *Chapter 4*) has suffered intensive industrial development with its associated environmental damage and this has been followed by severe economic decline providing significant opportunities for regeneration projects which have included wetland features through active management, enhancement, rehabilitation, restoration and creation. There are still opportunities for further development in the catchment. However, measures need to be taken to investigate previous landscapes and ecosystems and to ensure a return to full ecosystem functions and processes where these are achievable.

The experience described in the literature on the subject area, and described by practitioners in later chapters, highlight the concept that there is a crucial concept of providing an interface between people and their 'natural' environment - not only does this have a spiritual and educational value, but it encourages people to place a value on what they experience and this can provide the political will to encourage resource allocation to mitigation projects.

To avoid unnecessary pitfalls projects should be well planned and should not be started until it is clear as to what they are trying to achieve - why the project is promoted is as important as where it will be implemented and how it is achieved.

The literature identifies a hierarchy of methods of mitigation in terms of best practice of intervention determined by costs and a principle of minimum intervention being more likely to succeed. The intervention methods are:

management → enhancement → rehabilitation → restoration → habitat creation

This influences site selection and the need to prioritise locations and resources but it is also linked to biodiversity needs at national and regional levels in terms of rarity of habitat type and taking into account the importance of situation in relation to wildlife corridors (discussed in *Chapter 5*).

The evidence presented suggests that environmental projects at any scale are achievable on the 'back' of regeneration projects. This is well illustrated in the case study project examples described in *Chapter 8*. But a question remains as to whether there is any strategic overview of how this happens?

There is a clear concept of strategic planning for multi-use of river catchments that includes the need to balance social, economic and environmental factors and recognises the fact that these could conflict with each other or be mutually beneficial. There is also the possibility of wetland development as part of regeneration schemes, indicating the need for a detailed examination of a case study that examines the benefits provided by such projects that will better integrate social, economic and environmental targets. The River Don catchment, lying mainly in the county of South Yorkshire, demonstrates significant regeneration activity and further potential, and provides an ideal case study for such an examination. *Chapter 4* provides this detailed focus on the catchment

4.1 Introduction to the catchment.

This study describes the features of the catchment and examines issues of wetland degradation and the potential for reclamation, restoration, enhancement and creation of wetland features in the catchment of the River Don, which lies mainly in the county of South Yorkshire. Its national location is shown in **Figure 4.1** below, and a schematic diagram of the river system is shown in **Figure 4.2** overleaf.

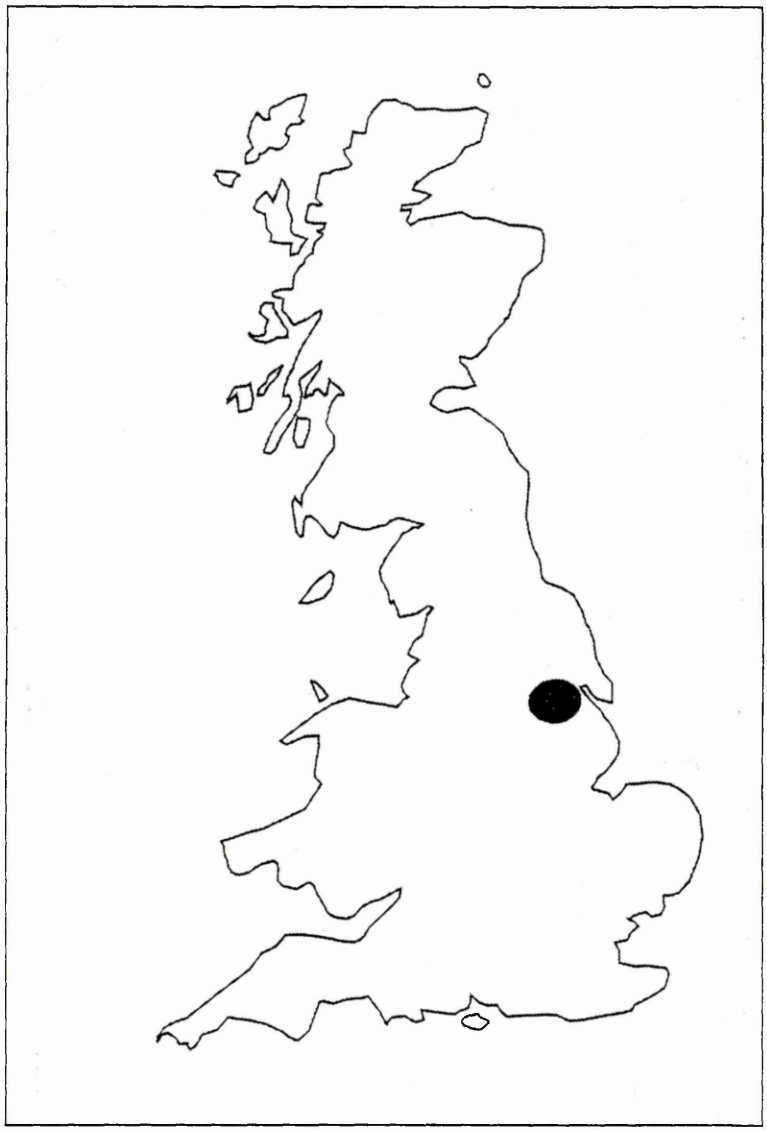


Figure 4.1: National location of the River Don catchment.

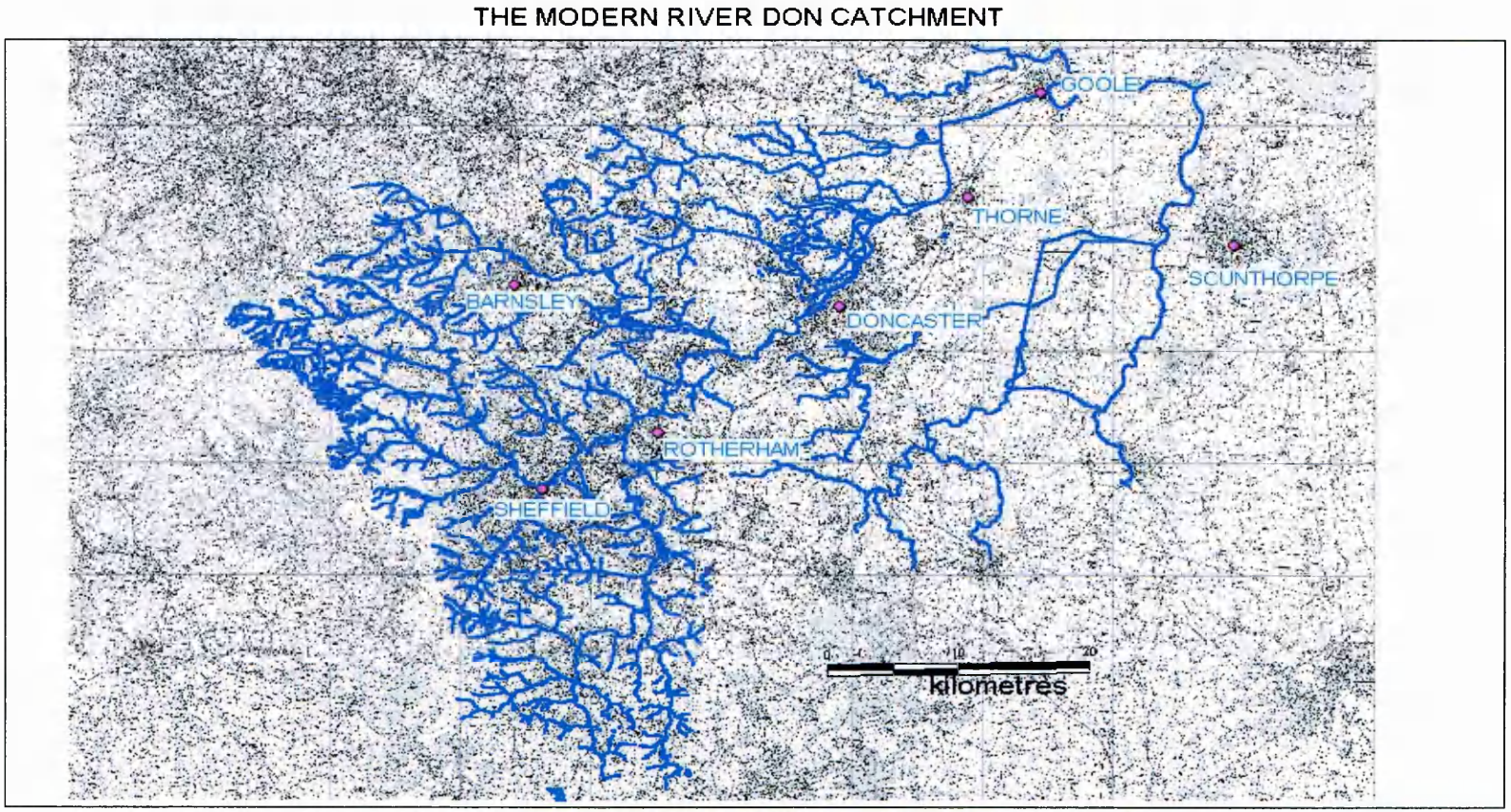


Figure 4.2: **Schematic diagram of the River Don and its tributaries.**

The study will describe the features, functions and issues associated with the catchment alongside its historical background, particularly in relation to the rise and fall of the major industries that developed in the region. It is argued that these issues will be significant in the potential future development of wetland features as an integral part of the social and economic regeneration of this dynamic area.

4.2 The physical features of the catchment.

The catchment of the River Don (shown in **Figure 4.3** rises at some 600 metres on the Millstone Grit moorlands of the Peak District to the north west of the city of Sheffield. It and its major tributaries, the Rother and Dearne, drain a catchment area of 1849 square kilometres within which 1.4 million people, live, work, recreate, use water and produce effluent (Edwards, 1997). The catchment area includes the major urban areas of Doncaster, Barnsley, Rotherham, Sheffield and Chesterfield. The Don system quickly descends from the Pennine moorlands through deep valleys to the city of Sheffield and Rotherham town on Coal Measure Sandstones, through Magnesian Limestone, into the town of Doncaster and Bunter Sandstones and out along the low-lying flood plain to its confluence with the River Ouse at Goole.

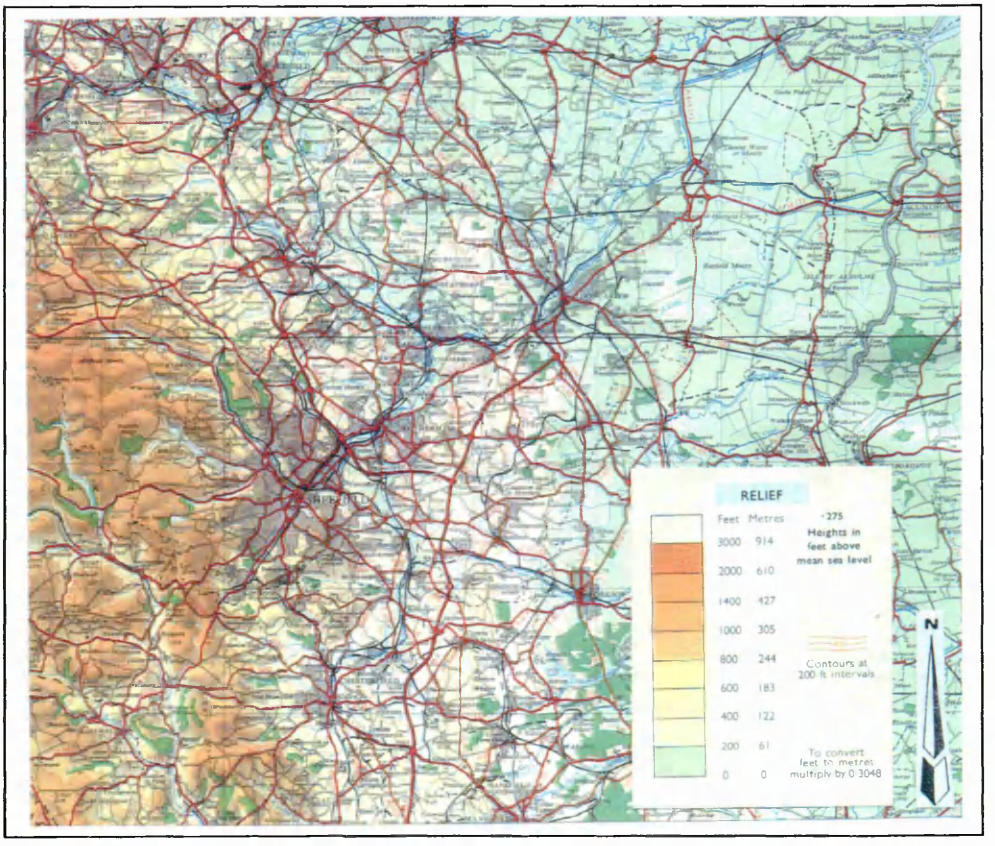


Figure 4.3: **Map showing the geographic region of the Don catchment.** Taken under licence from Ordnance Survey 1: 250,000 East Midlands and Yorkshire sheet, Revised to September, 1972. (Not to scale).

The varied landscape is a palimpsest of human activity over time that has included mining, quarrying, development, industrial decline and changing agricultural practices. **Figures 4.4 – 4.10** (Source: Author) demonstrate different characteristics of the riverine system in the catchment.

Figure 4.4: **Moorland headwaters.** (Source: Author)

Figure 4.5: **Upland rapid-flowing stream.** (Source: Author)

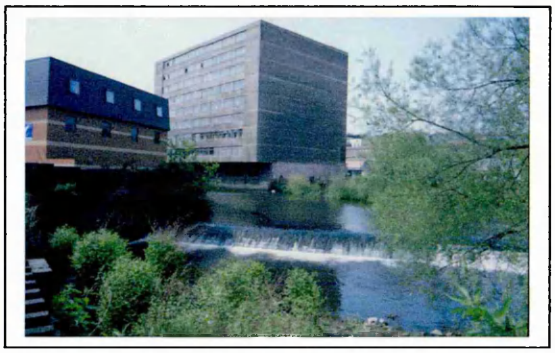


Figure 4.6: **The Don in Sheffield.** (Source: Author)

Figure 4.7: **The Don in Rotherham.** (Source: Author)

Figure 4.8: **The Magnesian Limestone area.** (Source: Author)

Figure 4.9: **Flat plain north east of Doncaster.** (Source: Author)

Figure 4.10: The Don as the Dutch River. (Source: Author).

The geology of the catchment is shown in **Figure 4.11.**

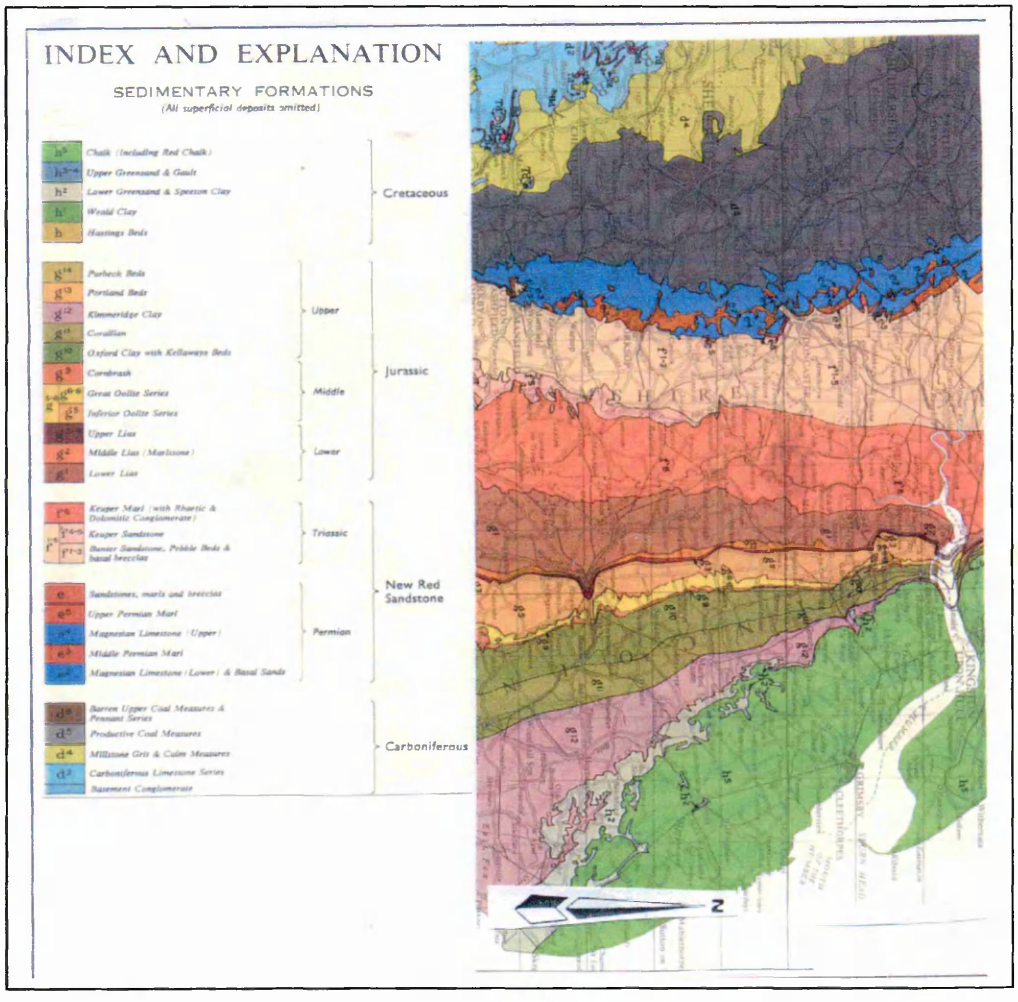


Figure 4.11: Geological map of the catchment area. (Source: Taken under licence from Ordnance Survey Geological Map of Great Britain, Sheet 2, England and Wales, 2nd Edition, 1957. (Not to Scale).

Of the main tributaries of the Don, the headwaters of the River Rother rise to the south of Chesterfield before flowing northwards through urban and industrial areas around Chesterfield and Rotherham until it reaches its confluence with the Don just to the east of Sheffield. The Dearne rises on the moors to the south and east of Huddersfield and to the west of Barnsley. It flows through Barnsley, Wath and Mexborough before joining the Don at Conisborough. The Don eventually joins the River Ouse and the Humber Estuary near the town of Goole. **Figures 4.12 – 4.14** show aspects of the Rivers Rother, Dearne and Ouse.

Figure 4.12: **Aspect of the River Rother.** (Source: Author).

Figure 4.13: **Aspect of the River Dearne.** (Source: Author).

Figure 4.14: **Aspect of the River Ouse.** (Source: Author).

In the west the area is dominated by fast-flowing streams, heather moorland and upland hill farms, but as the height of the land drops to the east the rivers are wider and slower flowing and industry and settlement become predominant. Even further to the east the landscape is flat with

grazing and arable land use together with intermittent settlement. Overlaying this basic land use pattern to the east of Sheffield is the social and economic evidence of one of the region's former major industries of coal mining. Agriculture and industry and their associated settlements have shaped most of the landscape over time leaving only pockets of semi-natural habitat, most of which has also been managed at some point in history. **Figures 4.15 – 4.17** illustrate elements of the Don catchment that demonstrate these features.

Figure 4.15: **The high moorland of the Kinder Plateau - part of which sheds water into the Don catchment.** (Source: Peak District National Park).

Figure 4.16: **The highly industrialised surrounds to the River Don in the east end of Sheffield.** (Source: Author).

Figure 4.17: **Settlement development in the Loxley valley *c.* 1900.** (Source: E.T.W.Dennis and Sons Ltd., Scarborough)

The Don and its tributaries have been the life-blood of the history of the local area providing the very means of life; of transport and access; of power; of industrial cooling and as a conduit for disposal of waste. More recently the rivers have become a source of recreation and pleasure. **Figures 4.18 – 4.23** illustrate these functions within the Don catchment.

Figure 4.18: **Broomhead reservoir on the western boundary of Sheffield - part of a series of impoundments that provide drinking water for the city.** (Source: Author)

Figure 4.19: The River Don at Thorpe Marsh power station near Doncaster.

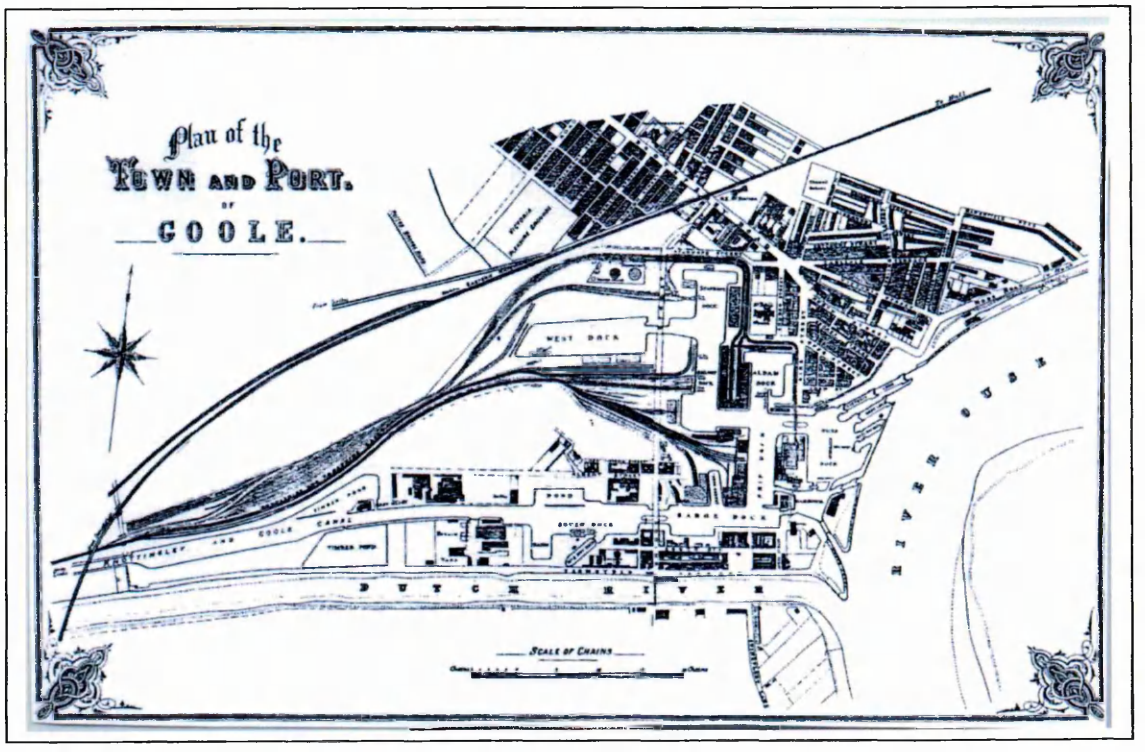


Figure 4.20: Map from the late 1900s of the confluence of the River Don (as the Dutch River) with the River Ouse showing the associated transport facilities.

(Source: Humberside College of Further Education)

Figure 4.21: **Goole Docks in the present.**

(Source: Author).

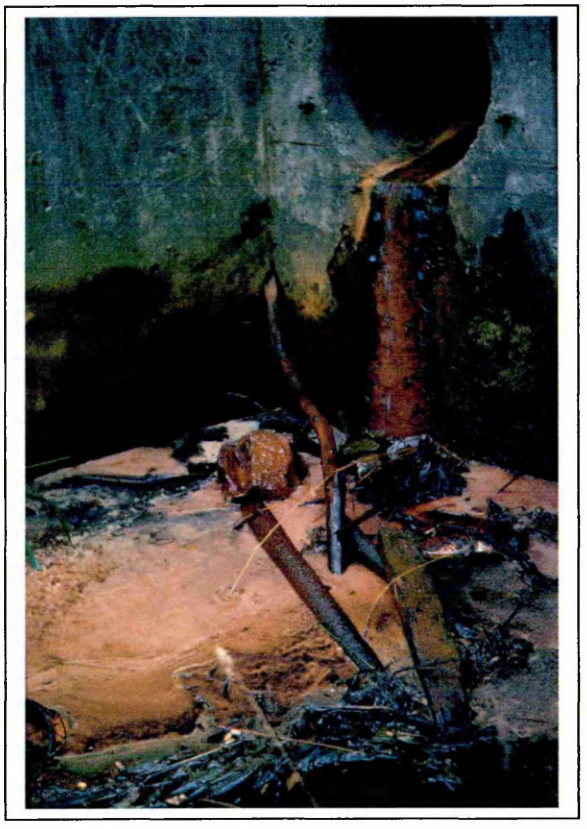


Figure 4.22: **Pollution in the Short Brook which feeds into the River Rother.**

(Source: Author).

Figure 4.23: **Recreational use of the river system.**

4.3 Historical changes in the catchment.

John Ruskin (1819 - 1900) art critic, poet and political commentator, once described Sheffield as the *"dolorous city on the dirty Don"* (Belshaw, 2000). An apt description of the river that has been relevant for over a century and is well demonstrated in **Figure 4.24** below.

Figure 4.24: **"Early Morning on the Don".** (Source: Dennis and Sons Ltd., Scarborough).

This view of the Don would not have been applicable before the advent of the industrial revolution of the nineteenth century when land use in the catchment changed rapidly from an agricultural scene with some minor industrial activity, to the scene that Ruskin presents. The polluted industrial landscape depicted would have been created, in the main, by the rapidly expanding metal trades, particularly in the Sheffield and Rotherham areas, and the coalfields that fed them further to the east and north.

The ancient name of the river has been described by Firth (1997) as *'ye River of Donn'* derived from the Old English *'don'* or *'dun'* meaning *'a deep or low channel'*. Firth also suggests that in its 'natural' state, the open valley landscape would have been dominated by a 'wild' wood habitat, with oak (*Quercus petraea*), birch (*Betula pendula*), wych elm (*Ulmus glabra*), ash (*Fraxinus excelsior*) and hazel (*Corylus avellana*) on the upper slopes and alder (*Alnus glutinosa*) and willow (*Salix* spp) carr on the wetter flood plain. Also in the flood plain would have been a combination of open water and wetland. The Don would have consisted of three channels meandering across the valley bottom. However, in the Neolithic period settlers made huge changes to the landscape of the valley by clearing and draining the forest to create pastoral areas for livestock (Firth, 1997). This clearance continued into the Bronze Age when the scattered buildings began to expand into settlements and the use of land for agriculture increased (Jones, 1993).

The main reason the Don is well documented as far back as the eleventh century is probably due to its importance as a fishery. Prior to the growth of industry around 1850, 31 species of fish had been identified in the river, including brown and sea trout (*Salmo trutta*) and Atlantic salmon (*Salmo salar*) (Firth, 1997). Firth also suggests that there is a considerable body of evidence of the abundant presence of salmon in the Don. One much quoted reference relates to an area on the banks of the Don in the east end of Sheffield called Salmon Pastures. However, there is some doubt as to the origin of this name. One theory is that it was named after a prominent family of that name but a more romantic theory is that it was due to the considerable number of salmon passing through the area on their way to the spawning grounds in the upper reaches of the river system. An apprenticeship agreement of 1850 (quoted by McClarence, 1988) from works at Salmon Pastures commented on the terms of employment in the contract that,

"Masters should not compel the lad to eat salmon more than twice per week".

Water quality has been a major issue within this catchment area, although there have been significant improvements within the past two decades. Settlement patterns in the catchment

have been greatly influenced by the proximity of its rivers. They were used as sources of drinking water and food and manipulated for their power. Evidence of settlement comes from prehistoric times when the river Don appears to have been a boundary separating two British tribes: the Brigantes in the north and the Corieltauvi further south. The earliest surviving evidence of human activity in or near the Don is the well-preserved Iron Age fort occupying the commanding heights overlooking the river and its flood plain at Wincobank Hill in eastern Sheffield (Hey, Olive and Liddament, 1997). Machan (1999), in describing the Don catchment around Sheffield in the latter part of the nineteenth century, shows a city that is rapidly expanding in population size with an associated geographical spread through increased industrial and settlement development. Crossley (1989) proposes that there can be few districts in Britain where rivers have been as intensively used for power as in the Don catchment. On almost 30 miles of five streams and their tributaries in the Sheffield area there are in excess of 115 locations for water powered mills. Crossley also states that the historical record identifies the first water powered sites in 1210 when a collection of mills was constructed at Lady's Bridge in Sheffield. Originally these mills were used for corn milling, paper-making or snuff-grinding, but latterly the great majority were used in the metal trades with the water wheels driving grindstones, forge-hammers, rolling-mills and wire-mills.

Hey (1972) states that the Sheffield region had many natural advantages which account for the eventual supremacy it achieved in the cutlery and other metal trades. The Pennine foothills and the coal-measure sandstones provided all the raw materials that were originally needed. He reports that the Tankersley bed of ironstone was being exploited at least as far back as 1161, and local iron was used in the secondary metal trades into the eighteenth century. Local coal was used in craftsmen's smithies and there was a plentiful supply of charcoal for furnaces. Coke was also readily available when there was a change to the use of this fuel for steel-making in the eighteenth century. The local stone to the west of the city, millstone grit, was ideal for grinding. In the many rivers coming down to the city from the Pennine moorlands there was a source of power.

The earliest suggestions of the use of water power in the catchment suggest that they were used for corn-milling with mills recorded in the Middle Ages in Sheffield itself (Lady's Bridge) and in what are now the Sheffield suburbs of Beauchief, Bradfield, Bradway, Brightside, Ecclesall, Norton, Owlerton and Wadsley (Crossley, 1989). Crossley also makes reference to the possible beginnings of water power being used for metal trades in the 1581 rental records for the Sheffield estates of the Earl of Shrewsbury which list wheel-rents relating to 14 cutler-wheels. Evidence of an incremental increase in metal trade occupations is evidenced in the formation of the Cutler's Company in 1624, an organisation that still exists (Crossley, 1989). Harrison's

survey of the manor of Sheffield of 1637 for the then lords of Hallamshire (the Howard family) lists the cutler-wheels and their tenants. In describing the rivers of the area, Hey (1998, p. 26) quotes Harrison as saying;

"These rivers are very profitable unto the Lord in respect of the Mills and Cutler wheeles that are turned by theire streames, which wheeles are imployed for the grinding of knives by four or five hundred Master Workmen".

In the eighteenth century the use of water power was coming to its peak with all available riverside sites being occupied and in production. There is a distinct impression of the density of mills on over-crowded streams, with an average over the entire river system of approximately four mills to the mile. In the nineteenth century, as the metal trades changed and developed in the area water power was gradually replaced by steam, gas and electricity as the costs of these new sources dropped and their flexibility and ease of speed-control improved (Crossley, 1989). But by this time, at the height of the industrial revolution, the environs of the River Don, and particularly in the Sheffield and Rotherham area, had become an industrial mega complex. A very different scenario to that depicted in a pastoral scene illustrated in **Figure 4.25**, and of the agricultural fields and small hamlets shown in a detail of Thomas Jeffreys' map of Yorkshire, 1767 – 1772 (**Figure 4.26**). The flat flood plain between Sheffield and Rotherham became hugely developed over a relatively short period of time and this is clear from the two maps of the Attercliffe area of Sheffield from the early 1850s and the early 1890s (**Figures 4.27 [a]** and **[b]**). **Figure 4.28** depicts the major works in the area *circa* 1885.

Figure 4.25: Christ Church, Attercliffe – a painting by J. Shaw *circa* 1845. (Source: Hey, 1998)

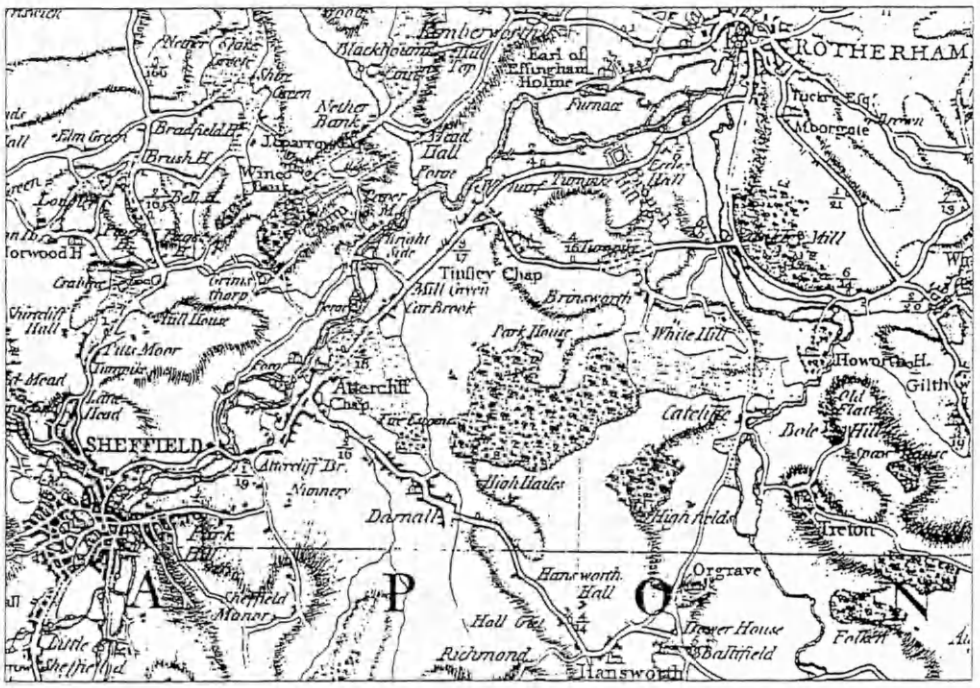


Figure 4.26: **Detail from Thomas Jeffreys' map of Yorkshire, 1767 – 72.** (Source: Hey, Olive and Liddament, 1997).

(a)

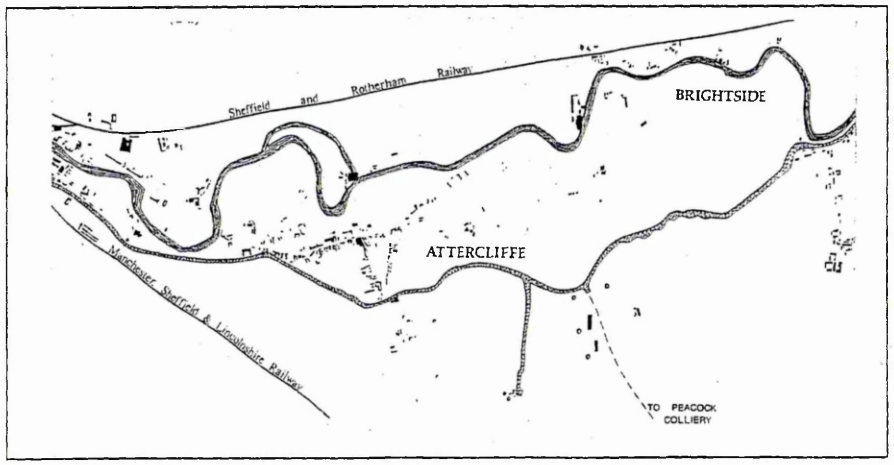


Figure 4.27: **Detail of maps of the Attercliffe area (a) in the early 1850s and (b) the early 1890s [See following page for (b)]** (Source: Jones, 2000)

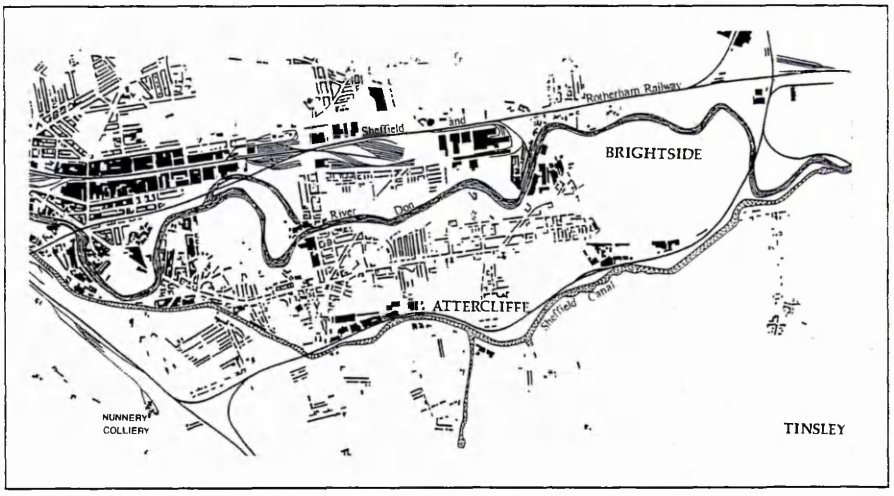


Figure 4.27: **Detail of maps of the Attercliffe area (a) in the early 1850s and (b) the early 1890s.** (Source: Jones, 2000)

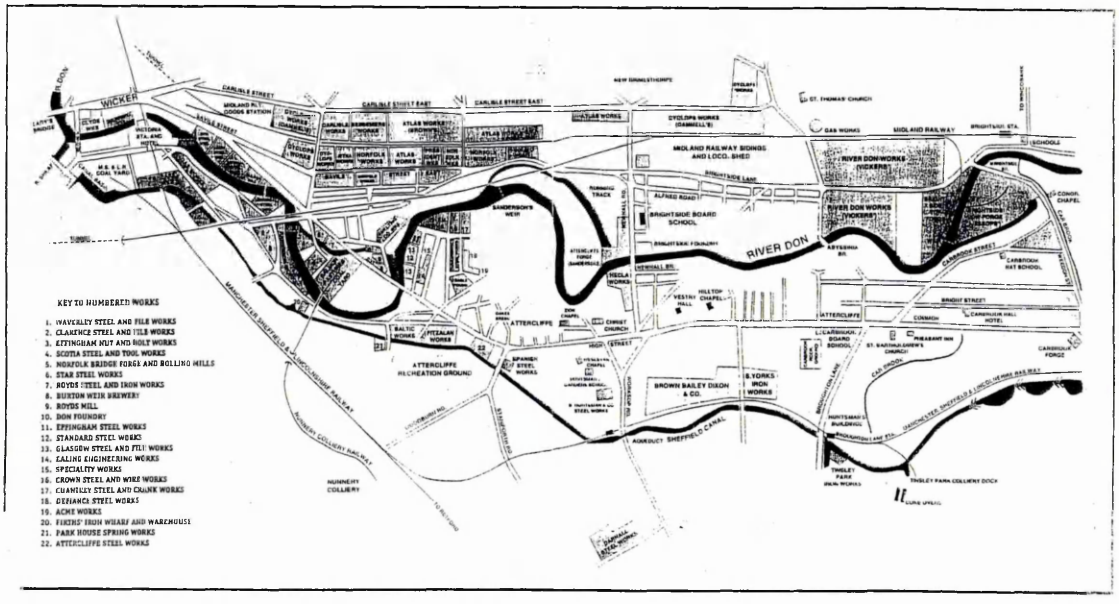


Figure 4.28: **Heavy industry in the east end of Sheffield, *c.* 1885.** (Source: Hey, Olive, and Liddament, 1997)

4.4 Pollution and health.

But the negative side of this rapid development was in its social costs, particularly with regard to health and sanitary conditions. Firth (1997) suggests that the River Don between Sheffield and Rotherham, became little more than an open sewer which, by 1860, was reported to be black and foul-smelling. Hey (1998, p. 189) quotes a report on the 'Conditions of our Chief

Towns – Sheffield' in a journal entitled *The Builder* from 1861 which presents the worst aspects of the borough in a startling way:

"The narrow streets rise and fall in the most irregular manner ... A thick pulverous haze is spread over the city, which the sun even in the dog days is unable to penetrate, save by a lurid glaze, and which has the effect of imparting to the green hills and golden corn fields in the high distance the ghostly appearance of being whitened as with snow ... The three rivers sluggishly flowing through the town are made the conduits of all imaginable filth, and at one particular spot ... positively run blood. These rivers ... are polluted with dirt, dust, dung, and carrion, the embankments are ragged and ruined; here and there overhung with privies; and often the site of ash and offal heaps – most desolate and sickening objects ... Sheffield ... is a town where authority is so divided ... that virtually there is no authority at all".

It is no wonder that people had a love/hate relationship with their rivers. Firth (1997) echoes these sentiments by quoting the Medical Officer of the City of Sheffield in his report of 1891, as describing the sanitary situation in the city as:

"It would be hard to find in any town poorer conditions than are to be found in the centre of Sheffield. Nuisance and unsanitary conditions of every description abound. Diseases such as cholera and typhoid spread from privy middens and filthy unpaved courts into rubble sewers and contaminated water and waste flows down steep hills into the river and streams".

The report recognised that this could not continue and measures were taken to improve the quality and delivery of potable water and to begin to develop systems to treat sewage effluent (Hey, 1998; Firth, 1997).

4.5 The industrial legacy.

The legacy of this period of intense industrial activity, despite large tracts of now derelict land, is one of engineered and canalised river channels. Evidence of means of controlling water flow to be used for power is still visible throughout the system with some remaining wheel sites and their associated weirs, mill ponds, head and tail goits. These weirs have had a profound effect on the river. Not only have they hindered the movement of fish populations up and down the river system but they have also permanently changed the river's landscape character, flow patterns and its ecology. **Figure 4.29** and **Figure 4.30** are schematic diagrams of the water powered activity in this period on the River Don and Loxley respectively.

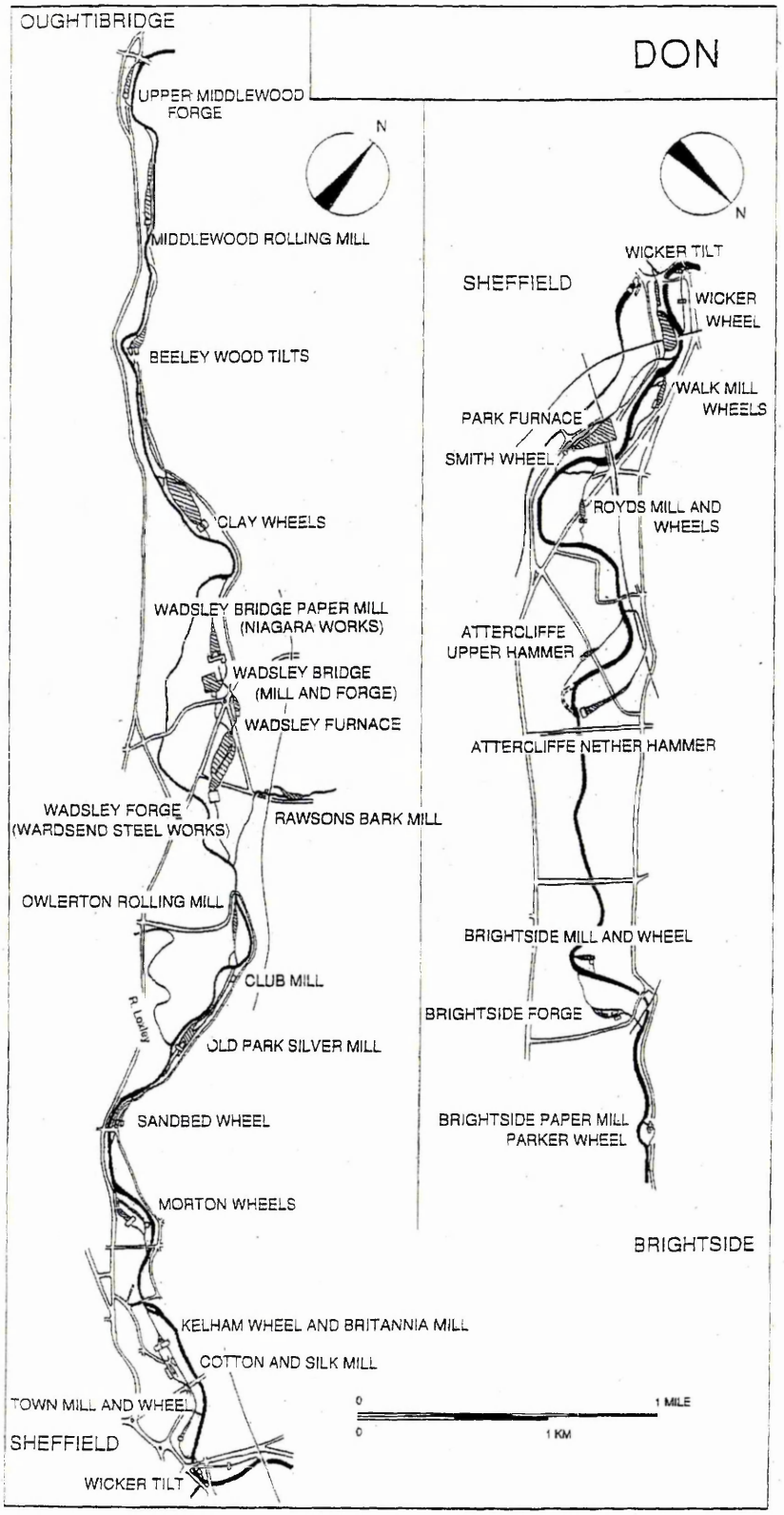


Figure 4.29: **Schematic diagram of the water powered industry once present on the River Don.** (Source: Crossley, 1989)

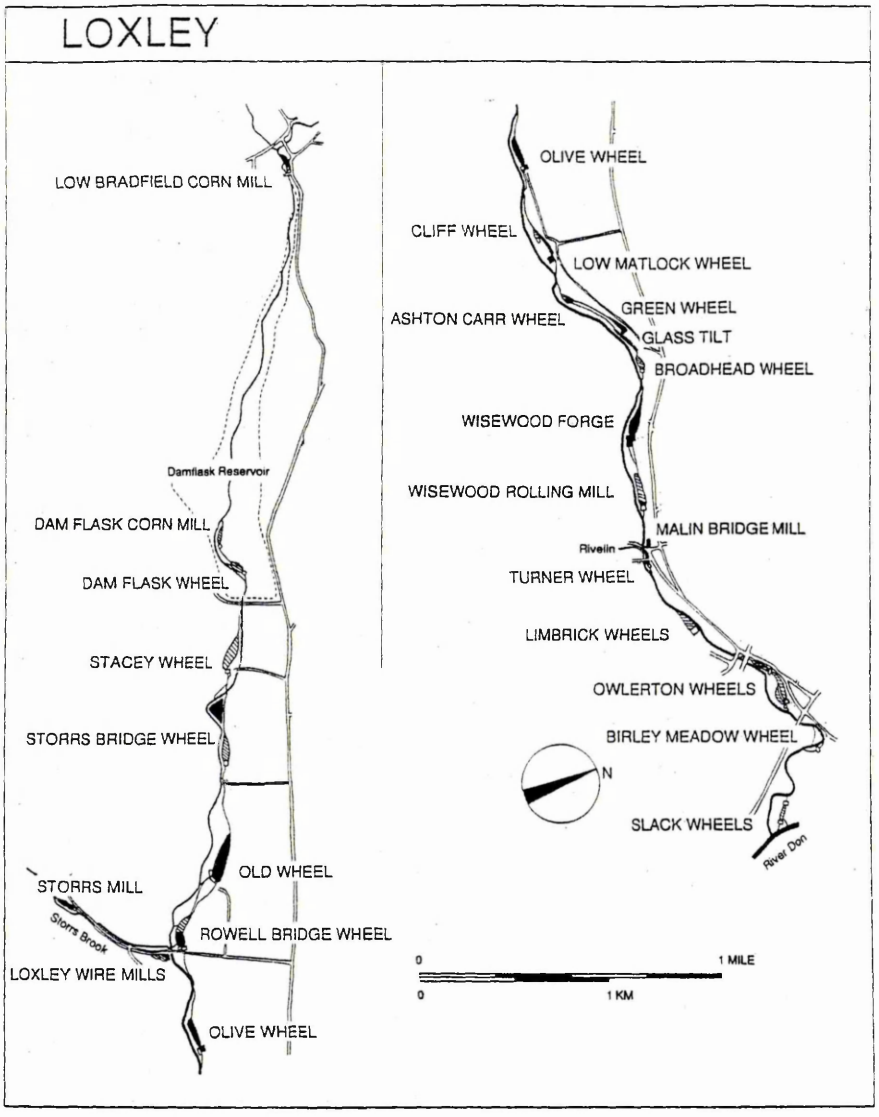


Figure 4.30: **Schematic diagram of the water powered industry once present on the River Loxley.** (Source: Crossley, 1989)

It should be noted that the majority of industry in the Loxley valley was destroyed when the Dale Dyke reservoir was breached in 1864 and the valley flooded with huge loss of life (Machan, 1999). However, much of the industry was rebuilt and surprisingly, because of other available sources of power in the period, water flow remained as an important source of power (Crossley, 1989). The weirs create a deep, fairly slow moving pool upstream of the barrier, a series of riffles which oxygenate the water as it runs over the weir, and churning below the weir as the force of water disturbs the riverbed. In doing so they create new habitats that would not normally be common in the region (Griffiths, 1995). Gilbert (1992) identifies the creation of mid-channel islands as another new habitat created by the redistribution of silt and gravel from

the churning effect at the base of the weirs. These new habitats provide a unique wildlife refuge for a variety of species. Some of the weirs would be passable as fish leaps by migrating salmon but the slope and height of others make it impossible for the fish to reach the spawning gravel beds in the upper reaches. An example of a remaining weir on the River Loxley is shown in **Figure 4.31**.

Figure 4.31: **Weir on the River Loxley.** (Source: Author)

A painting of Ryecroft Mill (no longer in existence) in the Sheaf valley is shown in **Figure 4.32**.

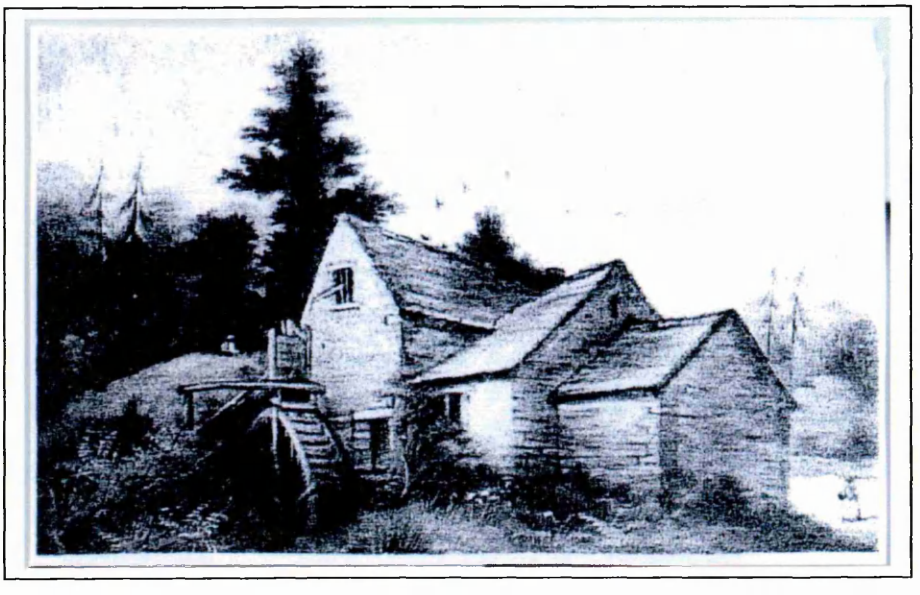


Figure 4.32: **Ryecroft Mill, Sheaf valley.** (An undated painting courtesy of Sheffield City Museums)

An 'overshot' wheel and its pentrough still remaining (although not operating) at Low Matlock in the Loxley valley are shown in **Figure 4.33**.

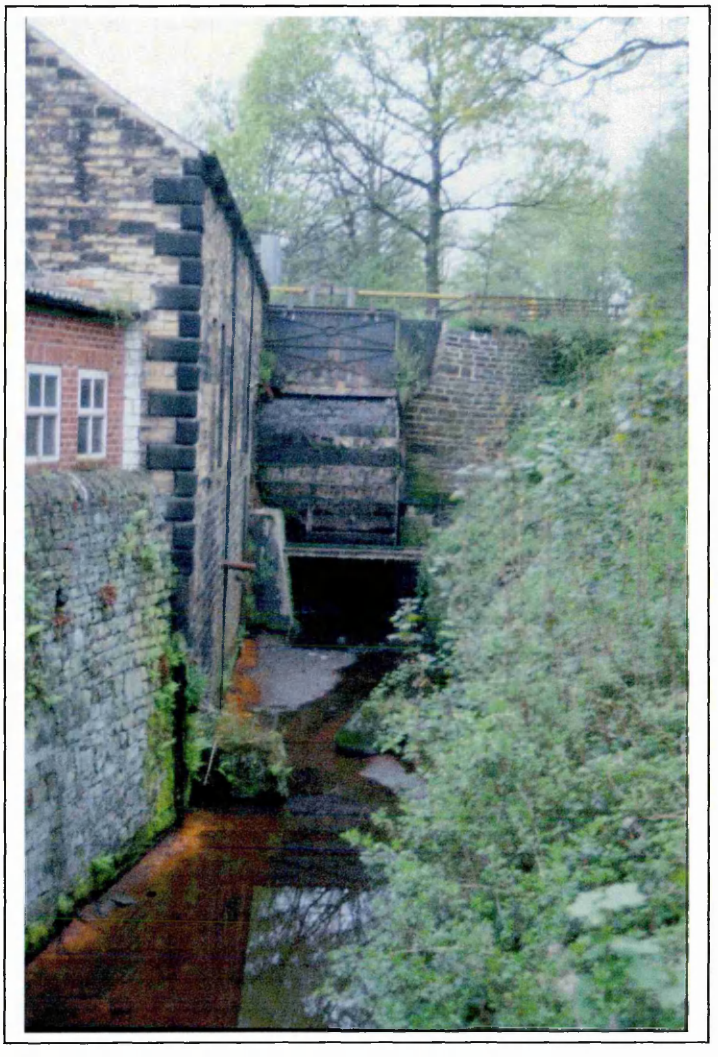


Figure 4.33: **Pentrough and 'overshot' wheel at Low Matlock in the Loxley valley.**
(Source: Author)

Figure 4.34 overleaf shows the working conditions in a 'grinding hull', as these buildings were termed locally. Here the edges of tools, particularly scythes and sickles would be sharpened on the grinding wheels driven by the water power. The occupation was extremely hazardous as wheels could break or explode under pressure underneath the worker and the air was filled with stone and metal dust. Many workers died at a relatively young age from various lung diseases associated with this dust.

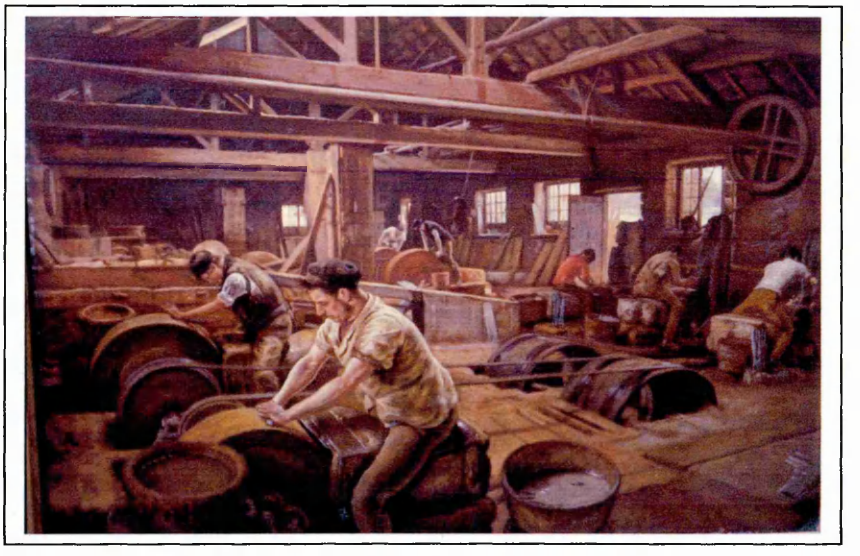


Figure 4.34: **Painting of a 'grinding hull'** (Source: Sheffield City Museums)

Figure 4.35 reproduces a site plan from 1892 of the engineered complex at Olive Wheel in the Loxley valley. Clearly seen on the plan are the *head goit* channelling water from the river to a holding reservoir (known locally as a mill *dam*) whose outflow could be controlled to move the *wheel* that provided power for the machinery in the *mill*. Leading away from the building can be seen the *tail goit* which returns the water to the river.

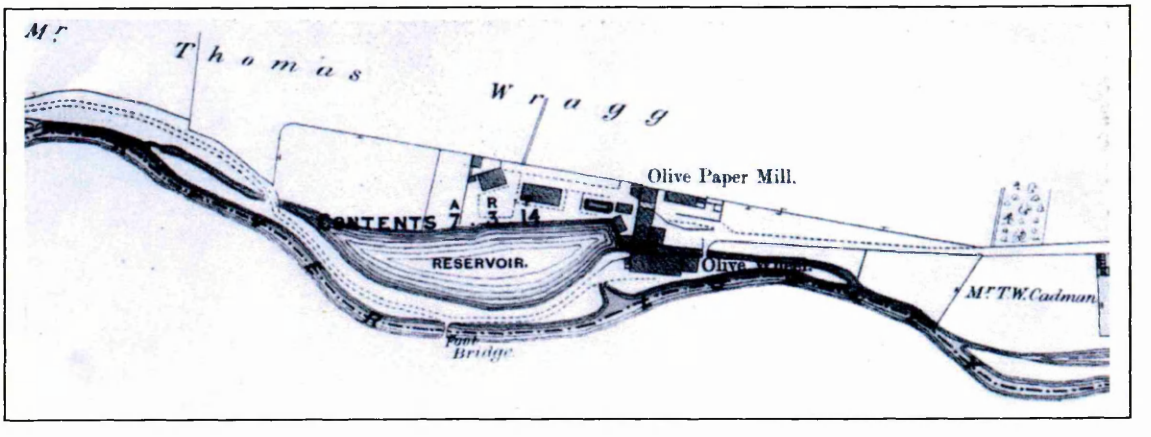


Figure 4.35: **1892 site plan of the Olive Wheel complex in the Loxley valley.**
(Sheffield City Archives)

The river could not cope with the new demands made on it to provide power for industry, to provide potable water and to act as an effluent dispersal mechanism and, as described earlier, at that time the river would not have been a healthy place to be near, yet thousands of poor people

lived and worked on its bank sides. Even in the 1970s, the catchment's river systems were described on numerous occasions in the popular media as amongst the most polluted in Europe. However, there have been significant improvements in recent years, particularly in relation to an initiative by Yorkshire Water Services called 'Rivercare'. This is a £400 million investment throughout the region upgrading sewage treatment works and combined sewage overflows (Yorkshire Water Services Ltd., online, undated). A recent project has been undertaken on the River Sheaf in Sheffield and is demonstrated in **Figure 4.36**.

Figure 4.36: **"Rivercare" initiative on the River Sheaf.**
(Source: Author)

Also, as Firth (1997) tells us, the creation of sub-surface sewer systems in the latter part of the nineteenth century helped to relieve the problems in the streets although they were mainly conduits to transport effluent into the nearest watercourse. In the early 1880s it was recognised that remediation was required. Thus in 1886 the first sewage treatment facility was opened at Blackburn Meadows on the boundary between Sheffield and Rotherham, although the treatment provided was very basic. Despite this simplicity of treatment the process does appear to have had limited success with a recorded increase of fish stocks downstream of the works. Ongoing improvements to the treatment system at the works have resulted in extensive improvements to

the quality of the water in the Don. This is particularly so following developments at the site in the last decade of the twentieth century to provide a series of anoxic zones and diffuse air-activated sludge treatment. **Figure 4.37** shows a number of graphs relating to recognised pollution measurements. It is very clear that the works improvements in the 1990s have had significant beneficial effects.

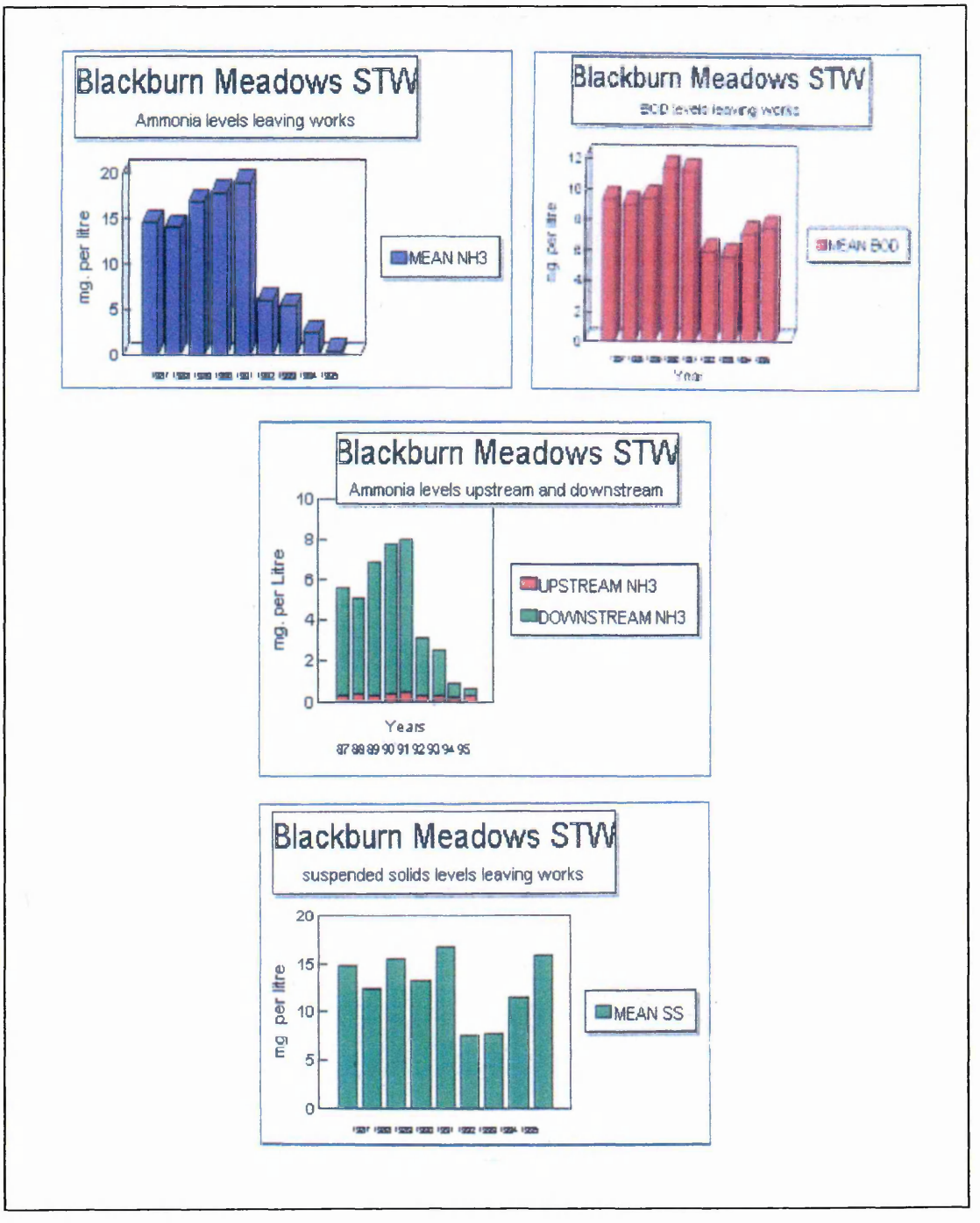


Figure 4.37: **Graphs relating to pollution indicators around the Blackburn Meadows sewage treatment plant.** (Source:Firth, 1997)

In the mid 1990s the National Rivers Authority [NRA] (now subsumed within the Environment Agency) issued a fact file for the Don catchment which supports the contention of improved river quality, reversing the legacy of pollution from South Yorkshire's industrial heritage. The NRA proudly stated that the River Rother probably has the most improved river quality in the UK. This has been achieved by improvements in sewage and industrial effluents, by the closure of coal carbonization plants and changes to colliery discharges. However, they accepted that the lower reaches of the River Dearne are not of good quality mainly due to sewage works effluent. The Environment Agency (1997) in their consultation report for the Don catchment Local Environment Agency Plan (LEAP) indicate an impressive improvement in the water quality of the River Don between the years 1990 and 1996. **Figure 4.38** shows an increase in the length of river stretches in the good to fair quality categories and a reduction in the stretches of poor quality.

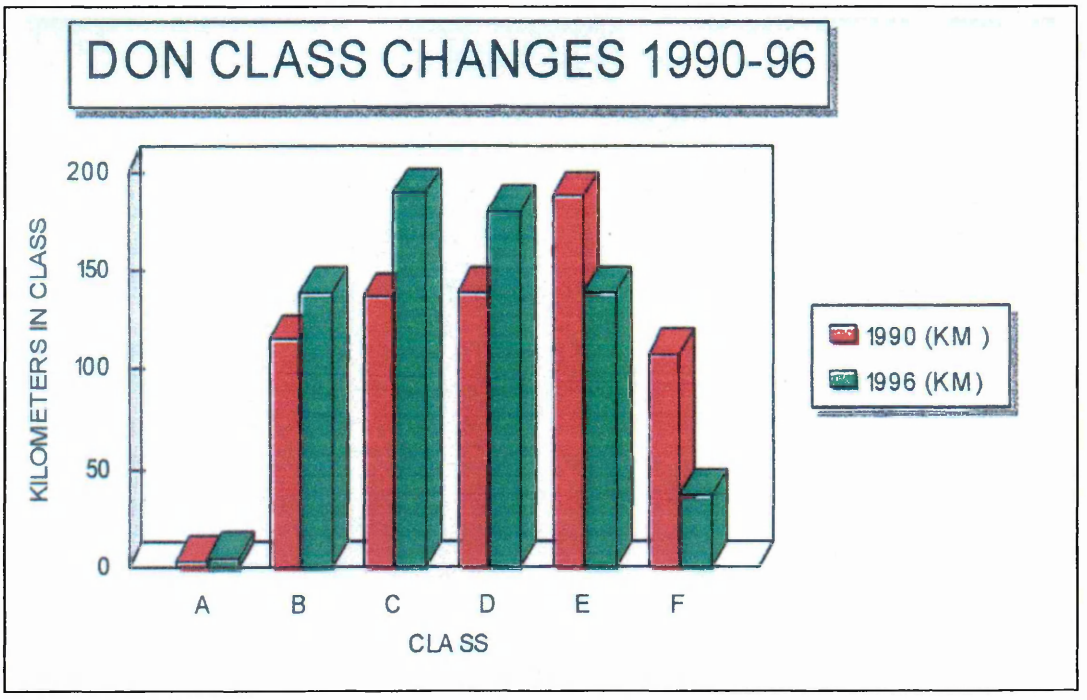


Figure 4.38: **Changes in water quality of the River Don from 1990 to 1996.** (Source: Environment Agency, 1997).

The Environment Agency uses two principal schemes for water quality assessment. These are the general quality assessment (GQA) scheme and the water quality objectives (WQO) scheme. The GQA scheme is used to make regular assessments of the quality of rivers to monitor trends over time and to be able to make comparisons. Four components were being developed for this assessment – general chemistry, nutrients, aesthetics and biology. In **Figures 4.39** and **4.40** can be seen the chemical (1996) and biological (1995) assessments of the River Don. Grades A and B are classed as good quality, C and D are fair quality and E and F are poor quality.

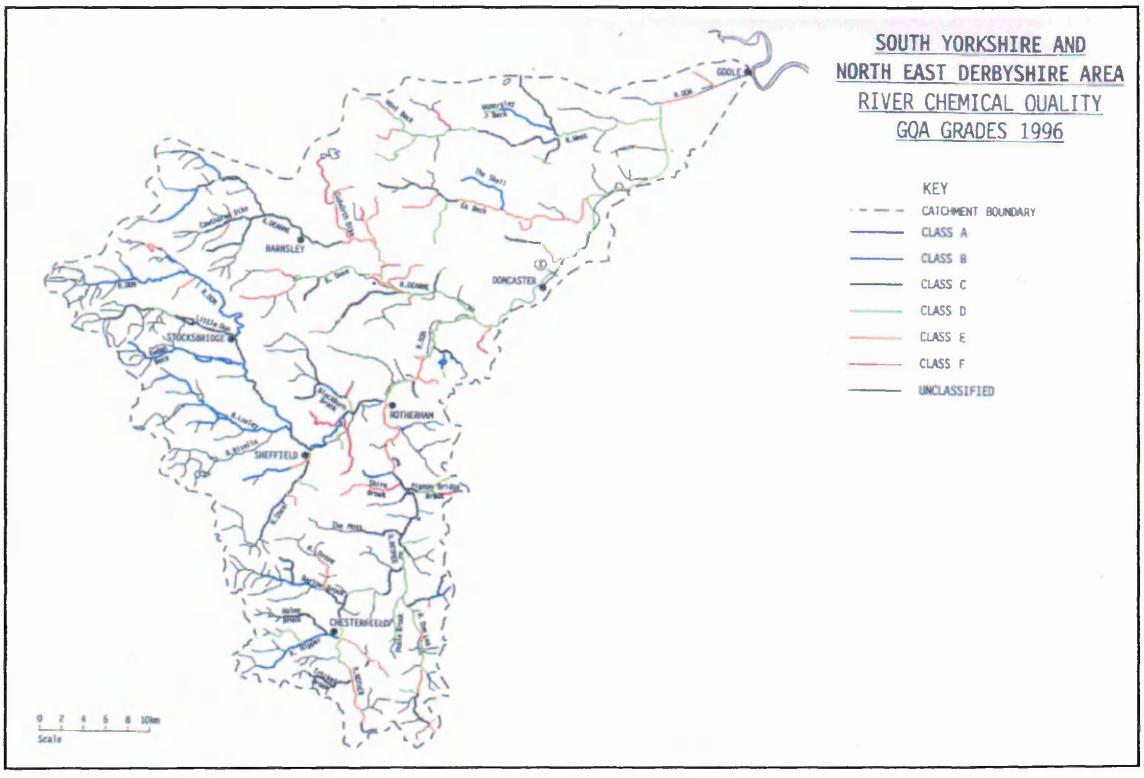


Figure 4.39: **River Don catchment chemical quality assessment grades 1996.**
(Source: Environment Agency, 1997)

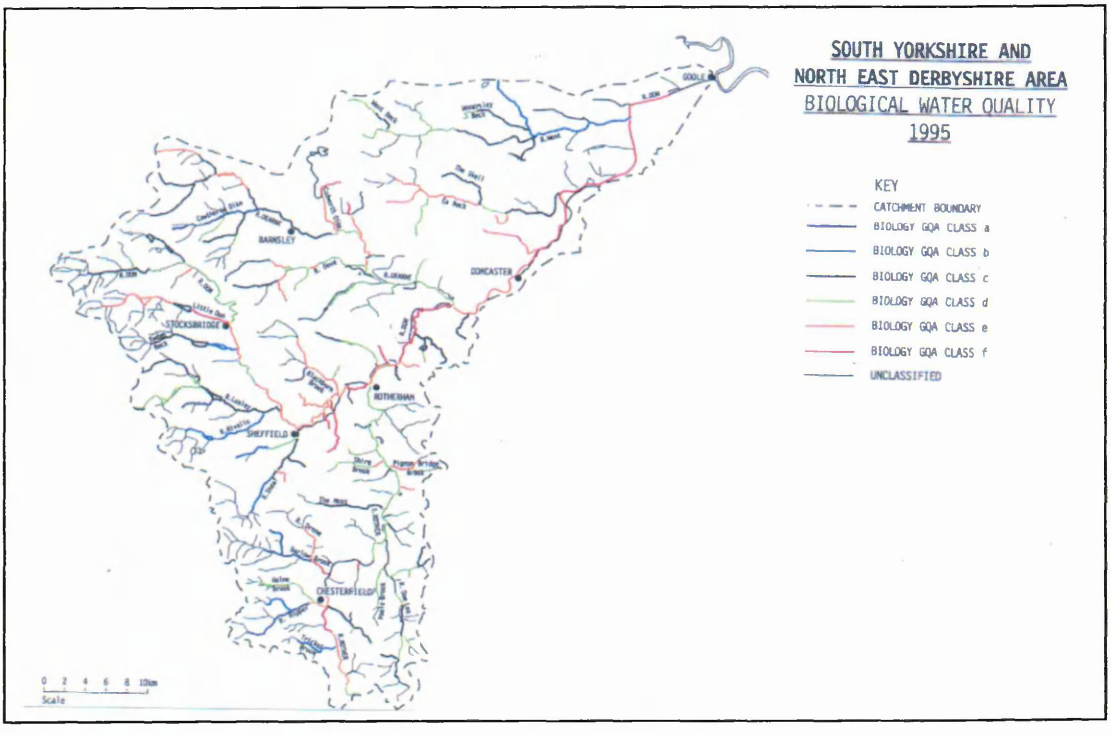


Figure 4.40: **River Don catchment biological water quality assessment grades, 1995.**
(Source: Environment Agency, 1997).

4.6 Impounding the flow.

The great need for drinking water and other domestic use increased as the population of the catchment rapidly grew alongside expanding industrial development. As more and more water-powered mills were built in the Sheffield area a more constant flow to operate these was required that would be only slightly affected by seasonal variance. According to Firth (1997) drinking water supplies in the late eighteenth and early nineteenth centuries were provided from five small reservoirs known as Whitehouse Dams which were situated adjacent to what is now Langsett Road in Sheffield. Consequently, because demand was continuously outstripping available supply, the Sheffield Water Company was created by Act of Parliament in 1830. One of its first tasks was to create a large storage reservoir at Crookes in Sheffield but the project that had the most significance was the creation of what is now the middle of three dams at Redmires following the damming of the Wyming Brook on the western edge of the city. **Figure 4.41** shows the reservoirs as they are today.

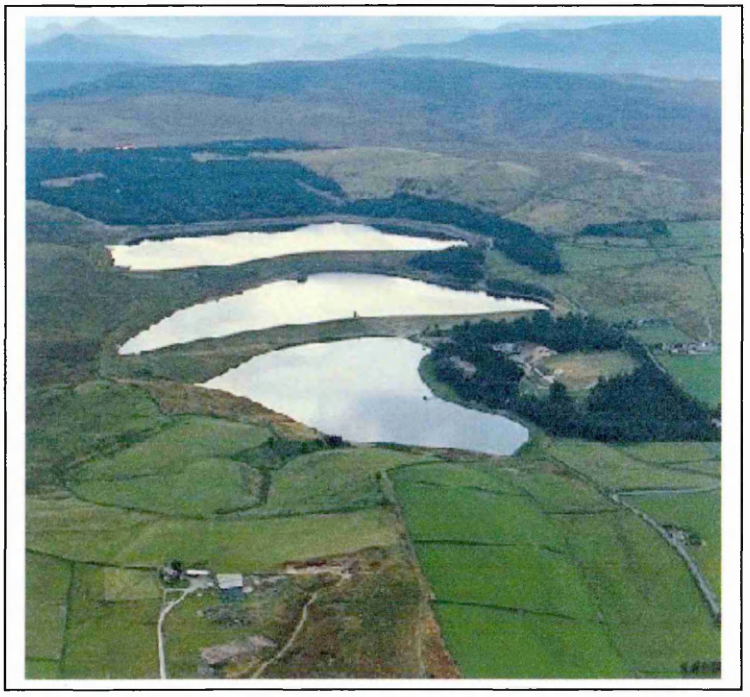


Figure 4.41: **The three reservoirs at Redmires, providing drinking water for Sheffield residents.** (Source: PDNP)

The success of this project provided the impetus for a series of further reservoir developments over the next century which took full advantage of the steep valley sides of the Don and its tributary valleys. **Figure 4.42** shows the location of these reservoirs in the catchment. **Figure 4.43** lists the reservoirs and shows the long history of such development.

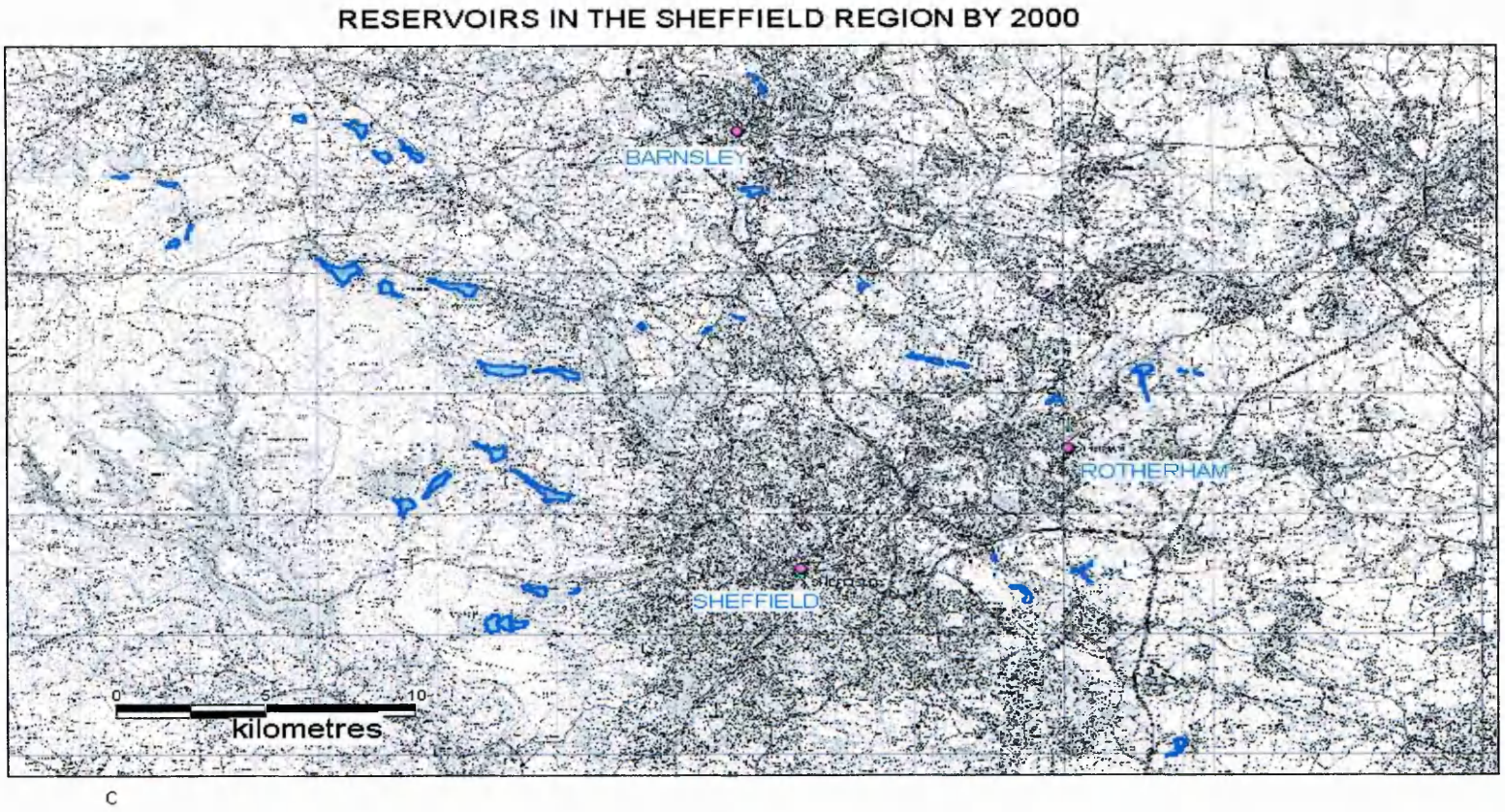


Figure 4.42: **Map showing impoundment reservoirs in the River Don catchment.** Source: Keith Harrison, 2003).

RESERVOIRS ON THE RIVER DON, 1996

Name	Grid Ref	Year Built	Useable TCM Capacity	Max Depth (meters)	Surface Areas (hectares)
Redmires Upper	SK 250 855	1854	1423	13.5	23
Redmires Middle	SK 264 855	1836	784	11.5	19
Redmires Lower	SK 268 855	1849	566	12.5	12
Rivelin Upper	SK 271 868	1848	220	9.1	4
Rivelin Lower	SK 277 867	1848	525	14.6	12
Strines	SK 232 905	1869	2059	23	22
Dale Dyke	SK 243 917	1875	2118	22.5	25
Agden	SK 261 923	1869	2541	25.9	25
Damflask*	SK 284 907	1896	5037	27	47
Broomhead	SK 269 959	1934	4919	27.9	50
More Hall *	SK 287 958	1930	2027	21.3	26
Langsett	SK 214 002	1905	5901	30.3	51
Midhope	SK 223 994	1903	1632	26.5	21
Underbank*	SK 253 992	1907	2727	16.5	42
Wharncliffe (no longer used)	SK 308 978	1878	65	6.1	3
Ingbirchworth	SE 216 060	1868	1332	15.5	23
Royd Moor	SE 222 048	1934	832	18.4	15
Scout Dyke*	SE 235 047	1928	709	13.2	16
Windleden Upper	SE 153 013	1890	606	17.5	8
Windleden Lower*	SE 158 019	1872	357	14.7	5
Snailsden	SE 136 040	1899	176	12.2	4
Harden	SE 153 037	1899	348	18.3	5
Winscar*	SE 153 026	1975	8296	41.8	47
Broadstones	SE 196 064	1859	367	11.1	8
Rivelin Depositing Pond	SK 287 869	1869	30	5.5	1.6

* indicates compensation reservoirs

RESERVOIRS ON THE SYSTEM WHICH ARE NO LONGER OPERATIONAL

NAME	GRID REF	PREVIOUS USE
Thrybergh	SK 477 961	Drinking water supply
(includes Firsby)	SK 494 958	
Lineacre System	SK 334 725	Drinking water supply
Crowhole	SK 321 748	Drinking water supply
Worsborough	SE 349 034	Canal Feeder
Elsecar	SE 384 995	Canal Feeder
Ulley	SK 753 876	Drinking water supply
Woodhall	SK 427 884	Canal Feeder (dry)*
Killamarsh	SK 431 870	Canal Feeder*
Harthill	SK 488 806	British Rail Feeder

Supplied water to the Barnsley Canal

* Supplied water to the Chesterfield Canal

Figure 4.43: Reservoirs on the River Don in 1996.

(Source: Firth, 1997)

It was important, particularly for the water powered industries that flow rates should not be adversely affected by the creation of these supply reservoirs. For this reason compensation reservoirs were built below the supply reservoirs and a statutory compensation release of water was imposed to protect the interests of industries which abstracted or utilised the flow downstream. When setting minimum compensation rates the releases of water into the river

were timed to coincide with the working periods of these industrial users and little consideration was given to these extreme variable flows on the river ecosystem.

4.7 Land drainage and flood alleviation in the catchment.

Jones (2000) proposes that land drainage was a feature of settlement of the eastern lowlands of the Don catchment from early times. He suggests that reclamation of land from marshland and land liable to flooding in the clay lowlands lying to the west of the Don and bordered by the River Went in the north and the settlement of Askern to the west had been prevalent from the medieval period. The land in this area is extremely flat and low-lying with nowhere more than six metres above sea level. Consequently settlements in the area were small and isolated and built on small, low islands in the marsh. Several place names in the area reflect this wetland dependency with elements such as *-ey* meaning an island in a marsh in Old English. An example of this is given by Jones (2000) as Arksey. He also points out the use of Old Norse in such names as Axholme where *-holme* has a similar meaning to *-ey*. Fishlake and Trumfleet both contain meanings from Old English for a stream (*-lake* and *-fleet*). The *-fen* of Fenwick indicates a marsh. In a personal communication by the author with Jones he also indicated other local names that reflect their past or present wetland nature. For instance, a tributary of the the River Sheaf is the Meersbrook whose name has its roots in *meer* which is indicative of a boundary. In this case this small stream has, over time, been the boundary between the ancient kingdoms of Northumbria and Mercia, between the sees of the Archbishoprics of York and Canterbury, between the parishes of Sheffield and Norton, and between the counties of Yorkshire and Derbyshire. Attercliffe means *'otter'* cliff and the *'owl'* in Owlerton refers not to the bird adopted by Sheffield Wednesday football club, but to alder trees which inhabit riverside banks.

The town of Wath on the River Dearne derives its name from the Old Norse and means a ford across a river. There are also several places in the catchment that have roots in the Old Norse word *-kjarr* meaning a marsh. Examples are Deepcar, Carbrook and Elsecar. There are also several place names indicating their wetland nature by the use of *ings*. For example Denaby Ings and Wombwell Ings.

More radical changes to the drainage of these lowlands to the east of this location towards the River Trent and containing the area known as the Isle of Axholme, were to take place in the seventeenth century (**Figure 4.44**). Large parts of the area, much of which lies at about two metres above sea level are reported by Jones (2000) to be a wilderness of marsh and bog as late as the early seventeenth century. Much of it was part of Crown owned Hatfield Chase but the

last deer hunt to have taken place in 1609 when a royal hunting party pursued 500 *swimming* deer in 100 boats (Jones, 2000)!

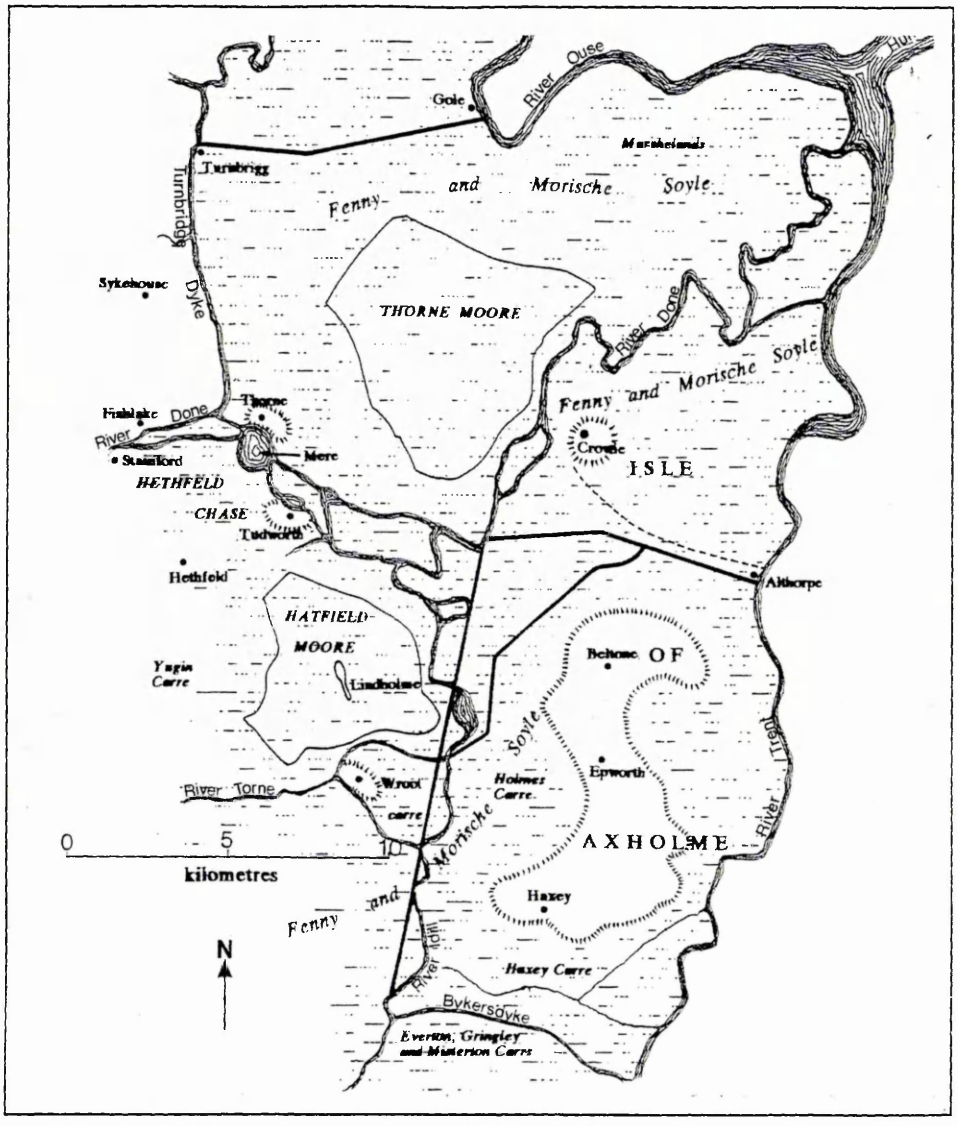


Figure 4.44: **The low-lying area around the Isle of Axholme (now known as part of the Humberhead Levels) before drainage in the 1620s, and the main features of Vermuyden's 1626 drainage scheme.**
(Source: Jones, 2000)

Hey (1979) reinforces this by suggesting that much of the lowlands lay under water for most of the year but in dry summers the fields produced rich grazing. Consequently few of the farms were large and most farmers had to have dual occupations including the manufacture of linen and the digging of turf. Hey also states that a Commission of several South Yorkshire landowners which had been set up during the reign of James I had inquired into the possibility

of a massive drainage scheme, but had concluded that it was impracticable. However, in 1626, in order to raise badly needed finances, Charles I required the scheme to be reconsidered and to employ a well-known Dutch engineer, Cornelius Vermuyden, to take charge. The project was financed by Dutch and Flemish families for whom Vermuyden acted as agent. One third of the drained land was to be granted to Vermuyden and his company, a third would compensate local inhabitants for their loss of commoners rights, and a third would remain with the Crown for loss of manorial and hunting rights within Hatfield Chase. This latter share was later purchased from the Crown by Vermuyden (Hey, 1979). The scheme resulted in a vast area of approximately 70,000 acres being drained. The original scheme involved changing the course of the Don so that it fed into the Turnbridge Dike and then into the River Aire, and by draining the straightened Rivers Torne and Idle into the Trent near Althorpe. One of the consequences of this work was to increase flooding at Fishlake and Sykehouse to the east so the scheme was amended to include the construction of a new channel for the Don to Goole known as the Dutch River after Vermuyden (Jones, 2000). Hey (1979) reports that there was much dissatisfaction with the scheme to the extent that there were riots, deaths of Dutch engineers and near civil war. However, passions abated and in some areas farming continued as normal as not all the area was drained. Hey [and Firth], (1997) also suggest that the scheme was of vital importance to the town of Goole as a port at the eastern end of an important transportation network.

Firth (1997) suggests that the consequent destruction of wetland habitats as a result of the drainage would today be considered as an ecological disaster of enormous proportions. He compares the pre-1626 wetlands as rivals to the wetland areas of Cota Donana in Spain which is now designated as an internationally important Biosphere Reserve. In the place of this diversity of wetlands is left a series of straight drainage channels that are regularly managed to remove silt and weed and consequently retain little habitat diversity.

4.8 River navigation.

Firth (1997) states that mercantile navigation had become well established on the tidal River Don as early as the twelfth century with busy ports at Turnbridge, Stainforth and Fishlake. But as trade and industry began to develop the Corporations representing the towns of Doncaster, Rotherham and Sheffield expressed the desire to improve the River Don for navigation.

Between the 1690s and the early 1720s several attempts were made to gain assent through Parliament for a Bill to allow improvement works but, initially these received limited support and some strong opposition, principally from mill owners. Firth (1997) reports that in October 1722 a meeting was held in Rotherham attended by representatives of the Company of Cutlers

Sheffield, the Corporation of Doncaster and the landowners at which a survey of the river would be carried out to consider three alternatives for the navigation upstream to Doncaster. These alternatives included locks on the river, cutting of a channel through the swamp or low grounds, and a cut through the high grounds. The consultants map is shown in **Figure 4.45**

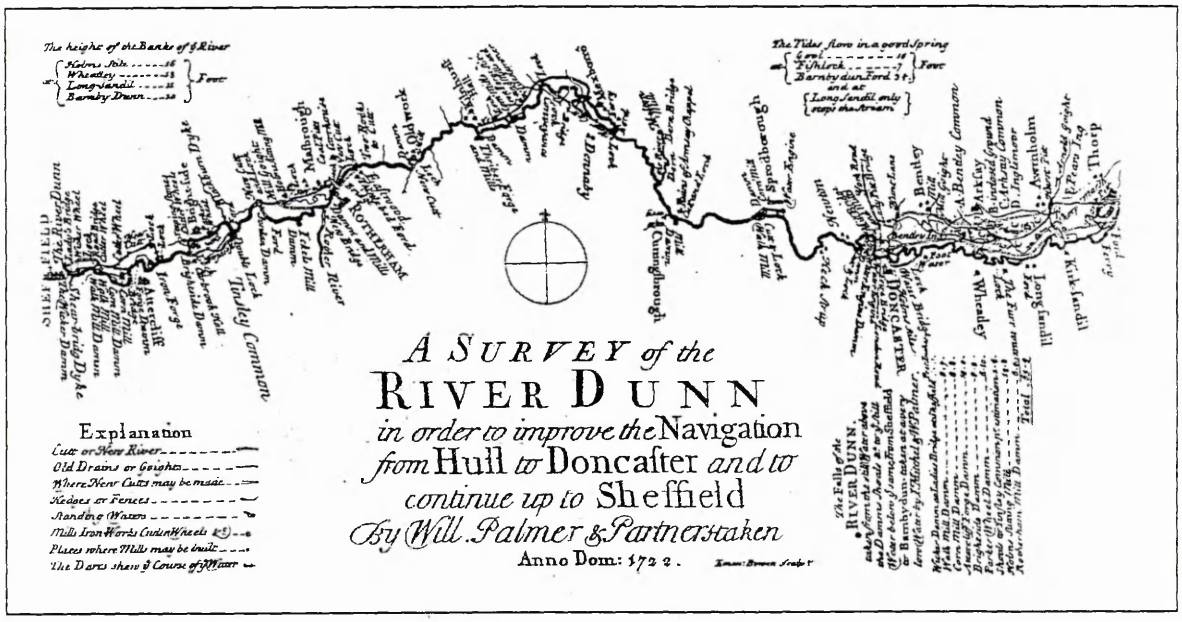


Figure 4.45: **Survey of the River Don by William Palmer and Partners, 1722.**
(Source: Firth, 1997)

Firth (1997) suggests that this effort was in vain as the subsequent Bill was defeated in 1723. Later that year more support for a scheme was obtained, particularly from the Duke of Norfolk, and the Company of Cutlers petitioned for a Bill to give them the necessary powers to make the river navigable between Doncaster and Tinsley on the eastern outskirts of Sheffield. The Bill received Assent in 1726 and was quickly followed by a further Bill, promoted by Doncaster Corporation, to improve navigation downstream from Doncaster to Barnby Dun. This was passed without incident.. In 1815 an Act of Parliament was obtained to extend the navigation into Sheffield centre along a newly constructed canal from Tinsley. Opened in 1819 this provided the possibility of sailing directly from the Humber to the centre of Sheffield.

4.9 Flood defence.

Firth (1997) goes on to report that, despite the ongoing drainage schemes, the lowlands were constantly prone to flooding and various schemes had been implemented over the years to enlarge the Don channel by embankment and other means in order to contain a 'normal' flood flow of up to 9,000 cubic feet per second. However, a major flood in 1932 provided readings of

12,000 cubic feet per second reaching Doncaster and it was decided to implement the lower Don improvement scheme to provide greater protection. This was a long-term development (completed in the 1950s) and during its implementation considerable development had taken place in these low-lying areas providing much faster return periods of surface water run-off. To cope with this would mean that suitable defence works would not be economically viable and the decision was made to create flood water storage areas in the washlands upstream of Doncaster and particularly in the Dearne and Rother valleys. Regulator gates were put into position at various points of the river systems which could be raised at times of flood to hold back excessive amounts of water and prevent flooding of downstream settlements. Of the five case studies used in this report three are situated on designated washlands for flood control and storage. These are Old Moor, Rother Valley Country Park and Woodhouse Washlands. **Figure 4.46** shows a sluice to release floodwater from a storage area at Kilnhurst on the Don near Rotherham.

Figure 4.46: **Sluice gate to release floodwater from a temporary storage area on the Don flood plain at Kilnhurst, Rotherham.** (Source: Author)

4.10 The South Yorkshire and North Derbyshire coalfield.

Jones (2000) suggests that the first collieries were in operation in the medieval period. Because the technology that was available at the time (bell pits, drift mines and shallow shafts) only allowed coal to be obtained from shallow levels the mines were relatively small but widespread. Jones goes on to say that this shallow resource was more or less worked out by the early nineteenth century and deeper mines had to be developed as the coal beds dipped downwards to

50,000 miners were employed in fifty collieries which produced 30% of the British coal output.

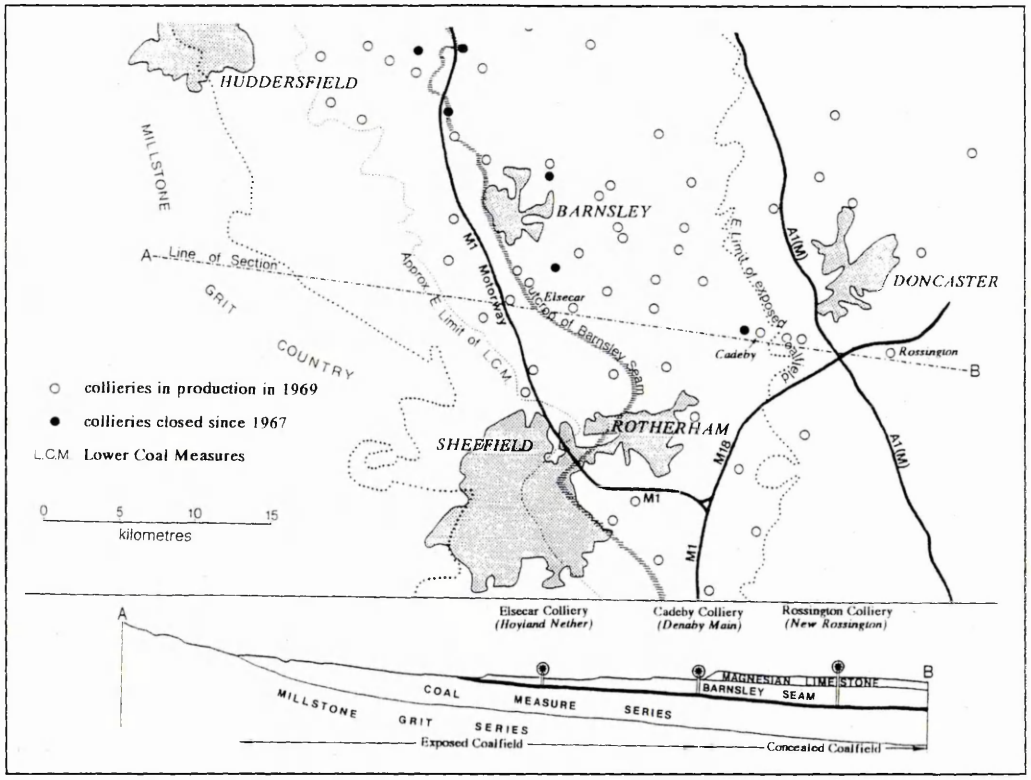


Figure 4.47: The South Yorkshire coalfield in 1969. (Source: Jones, 2000)

The main water courses in this coalfield area, other than the lower reaches of the Don itself, are the Rivers Dearne to the north east and the Rother to the south and south east. Firth (1997) states that the Dearne lies wholly within the coal measures area and consequently has received substantial pollution from that source. He reports that when the Dearne and Dove navigation was opened in 1810 a means of easy navigation was provided to transport the coal to the steel works of Sheffield and Rotherham and elsewhere around the country. Because of this there was a substantial increase in the size and number of collieries along the Dearne and an associated rapid increase in population. In these early expansion times the local watercourses became the most convenient form of disposal for both domestic and industrial waste. Firth (1997) also suggests that the River Rother was very similar to the Dearne at the beginning of the twentieth century having rich coal deposits beneath the valley floor. Thus, a similar history of coalfield extraction and mine development occurred. Localised urban development also took place with the development of chemical industries and coking plants along the tributaries of the Doe Lea, the River Drone and Pools Brook. The trade effluent from these plants quickly reduced the quality of these water courses and the Rother to a lifeless chemical sewer although the river's

water quality is much improved following the demise of many of the industries. Habitat restoration schemes have recently been attempted on the channels of both the Dearne and the Rother by the Environment Agency (Firth, 1997). This was mainly to encourage the recovery of the fish populations and was based on the realization that rehabilitation of species requirements did not rely purely on water quality improvements but on the re-creation of physical features required by individual species. Such techniques as the encouragement of different flow velocities, gravel rather than silted river beds and back channels have been used. Photographs of the two initial schemes are shown in **Figures 4.48** (Dearne) and **4.49** (Rother).

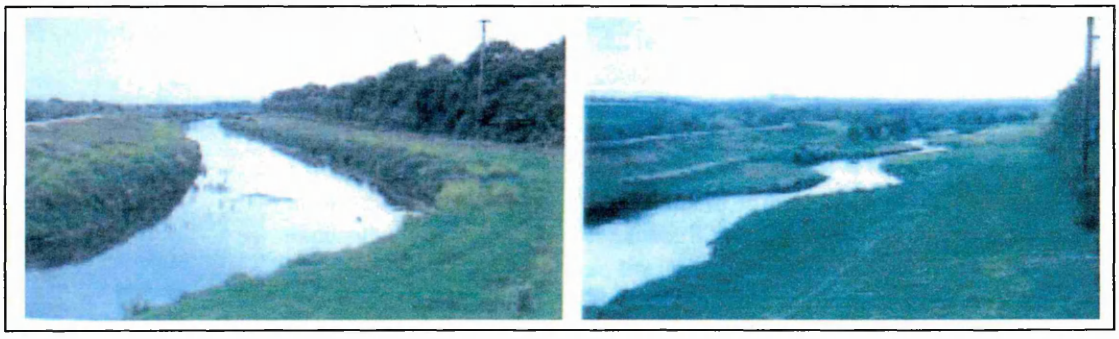


Figure 4.48: **Habitat enhancement on the River Dearne.** (Source: Firth, 1997)
In an attempt to recreate some of the features originally present and to provide spawning conditions a section of this channel was re-engineered in 1995 to create a series of bends. The full benefits of this work are unlikely to be realised for several years as they require the river's natural influences to scour and deposit bed material which provides the deep pools and shallow gravel riffles so important for the maintenance of fish populations.

Figure 4.49: **Habitat enhancement on the River Rother.** (Source: Firth, 1997)
The creation of a weir to produce oxygenated water and differing water depths and a backwater bay. Both to increase the diversity of habitat for the fish population following water quality improvements.

Writing in 2000 Jones reports that there were only two deep mine collieries still working at the time and much of the evidence of past mining, such as the pithead wheel gear and the huge mounds of waste material known locally as 'slag heaps', had been swept away to give a new 'greenfield' image to attract inward investment and thus attract employment opportunities.

One element of visible evidence of former mining areas that has benefited nature conservation has been the creation of subsidence flashes where the surface sinks with the underground collapse of mine 'galleries' once they are worked out. Several wetlands that have developed in these areas are now important for wildlife and examples can be seen at Catcliffe Flash in Rotherham and Broomhill Flash on the Doncaster and Barnsley administrative boundary. This latter site is part of a complex of wetland areas in the Dearne valley which are being promoted by, and developed as, a 'green' backdrop to the regeneration of the whole area. Part of this complex of sites is the Old Moor wetland site, now run by the RSPB and which is one of the case study sites of this study.

Another way in which social and environmental issues have questionably benefited from mining activity has been opencast mining on the areas of shallow buried coal seams. In some cases this has resulted in recreational and landscape redevelopment with habitat creation schemes built in. The problem has always been that such activities completely obliterate existing nature conservation features. One such site is the Rother Valley Country Park on the administrative boundaries of Sheffield, Rotherham and North East Derbyshire, which is also one of the case studies in this report.

But an increasing problem from the decline of the coal extraction industry has been that many of the deep mines have now flooded as they were abandoned and pumping ceased, and the associated contamination is seeping through adits into watercourses. The contamination is often acidic and high in iron content. Many of the mine discharges were abandoned prior to nationalisation of the industry and legally no one has taken responsibility for them. The Environment Agency and the Coal Authority are addressing the issue and are seeking to obtain funding for minewater remediation (Firth, 1997; Edwards, 1997). **Figure 4.50** shows the sites of trade discharges and abandoned minewaters in the River Don catchment.

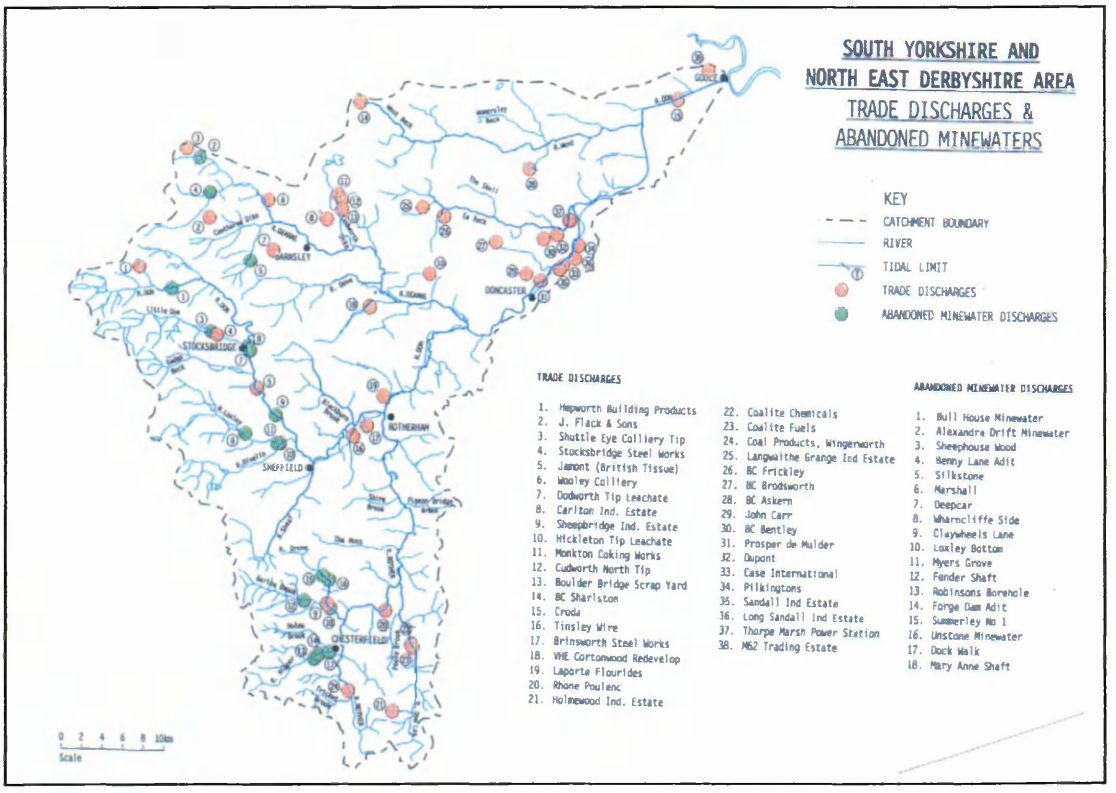


Figure 4.50: **Trade discharges and abandoned minewaters in the River Don catchment.** (Source: Edwards, 1997)

A particular example of this pollution was to be found on the Don at Bullhouse near Penistone. More recently abandoned mines where the pumps have been switched off are likely to produce new minewater discharges in the future (Edwards, 1997). However, remedial works have taken place at Bullhouse at a cost of £1.2 million where it is intended that the project will restore fish and insect life to 6 - 8 kilometres of the river. The Bullhouse mine was closed in 1918 and the ochreous discharge was one of the worst in the country. The treatment system pumps the discharge to a settlement lagoon and then a 'polishing' pond where the water is treated further before being discharged back to the river. Construction of the project was completed in August 1998 (Bullhouse project advisory leaflet). The effects of the minewater are shown in **Figure 4.51** and a schematic diagram of the project is shown in **Figure 4.52**.

Figure 4.51: **Effects of minewater pollution on the River Don at Bullhouse.**
(Source: Environment Agency, 1999)

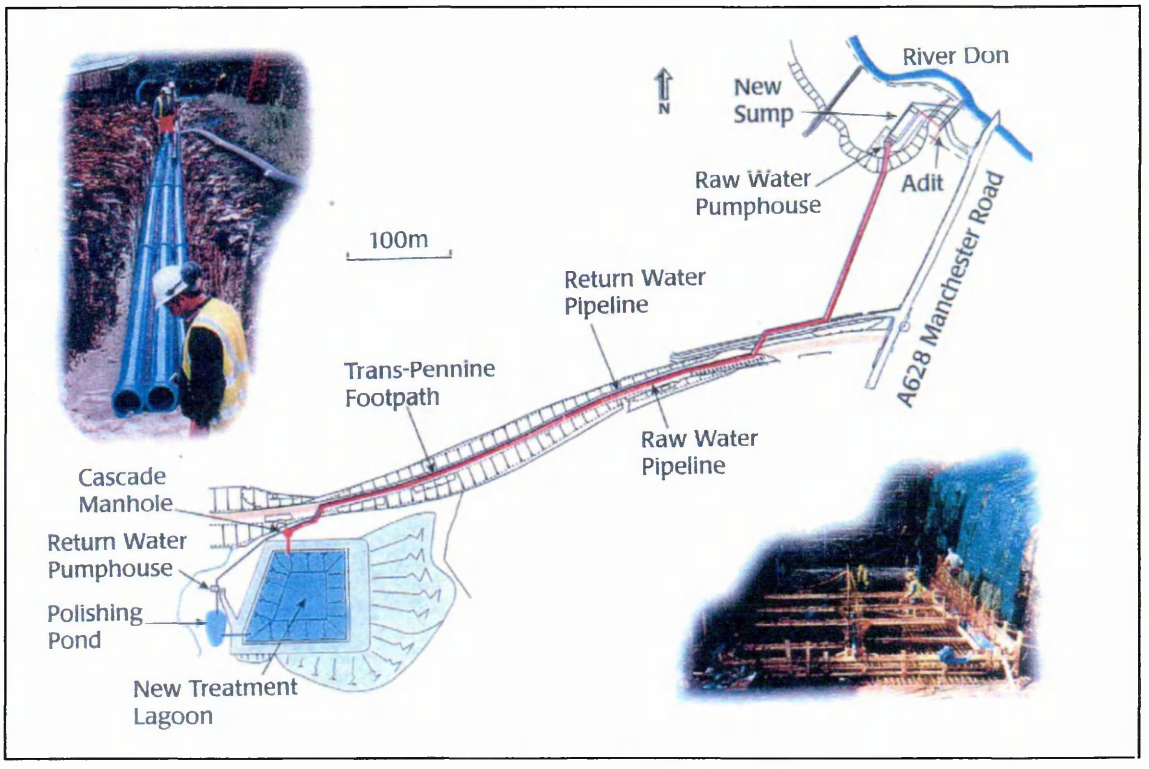


Figure 4.52: **Schematic diagram of the Bullhouse project.** (Source: Environment Agency, 1999)

But changes to minewater pumping have also affected the volume of water and thus the flow levels of the watercourses into which the minewater was discharged. Because increased flows could dilute sewage effluents the cessation of pumping has had a deleterious effect on water quality. At the nearby Woolley Colliery in West Yorkshire pumping has been restarted to help minimize effluent pollution in the affected watercourses (NRA Fact File for the Don catchment, mid 1990s)

4.11 The historical changes that impact on wildlife.

There appears to have been little detrimental effect on wildlife in the catchment until the arrival of a rapidly expanding series of water mills were developed. Such mills were hives of human activity with associated noise, human presence, and air, land and water pollution that disturbed or affected the locally indigenous wildlife. Spreading settlement development associated with developing (and spreading) industry would have removed significant areas of wetland habitat from the valley bottoms in the catchment. Equally large areas of land would be decimated through coal extraction and subsequent spreading of toxic spoil. However, the collapse of mine galleries has created surface depressions that often fill with water and become important wildlife refuges.

Drainage of land is often perceived as being only pertinent to specific time periods but continuing changes in agricultural practices and the operations of Internal Drainage Boards in the catchment mean that drainage continues to this day.

4.12 Modern issues in the catchment.

Current issues relating to water quality still include sewage treatment outflows and combined stormwater overflows together with industrial effluent outflows, minewater outflows, agricultural slurry and chemical leaching events. Existing research and practical applications of reedbed water treatment systems may well have implications for application in the catchment area. Such systems can be of benefit for both large and small applications and as engineered or more 'naturalistic' landscaped constructions. They also have the potential to provide an increase in available wetland habitat.

At present water quantity in the catchment is not a major issue but it may be in the future. The net usage of water by private abstractors in the catchment in 1992 is illustrated in **Figure 4.53** below. In this context, the net use is the difference between the licensed abstraction and the estimated return flows to the river. It reflects the amount actually removed from the river or

ground which is either discharged back to the river some distance downstream, discharged to another river, or lost.

Agriculture	Industry and Cooling	Power	Miscellaneous	**TOTAL**
9	95	21	17	**142**

Figure 4.53: Net usage by private abstractors in the Don/Dearne/Rother catchment in 1992, measured in Ml/d. (Source: National Rivers Authority, 1994).

The NRA (1994) made forecasts of unsuppressed private demand growth as follows:

Spray irrigation (bulk of agriculture)	*4% per annum*
Industry/cooling	*1% per annum*
Power	*0% per annum*
Miscellaneous	*0% per annum*

They suggest that the catchment does not have the resources available to sustain growth rates of 4% per annum for spray irrigation. The NRA were required to take responsibility for providing sufficient water to be left in rivers and aquifers to meet ecological needs. Unfortunately, assessing these ecological needs is difficult since they depend on a wide diversity of species with complex, seasonally varying needs (National Rivers Authority, 1994). At the time of writing the report there was no resolution to this matter other than to say that discussions were taking place at a national level between themselves, the National Farmers Union and the Ministry of Agriculture, Fisheries and Food.

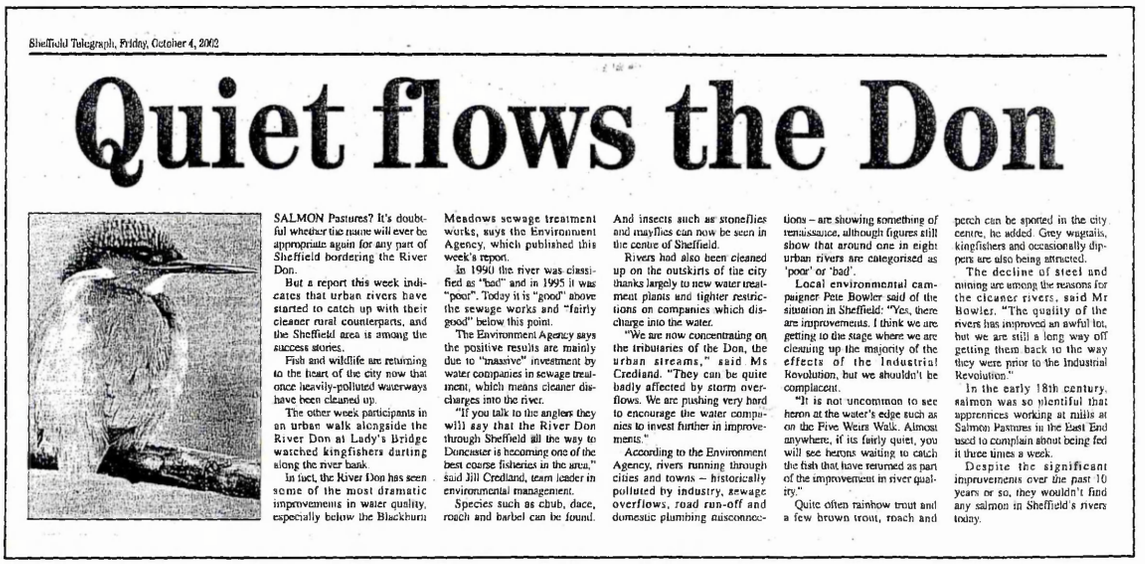
Regeneration of the former sites of heavy industry has become a major feature following the collapse of the steel industry during the 1970s left 40% of land within the east end of Sheffield derelict and by 1983 employment in the area had decreased by 60% (Watts, Pearson and Rotherham, 1987). Sheffield City Council started work on a Local Plan for the area in the mid 1980s but were superseded by the creation of the Sheffield Development Corporation in 1988 which was taxed with the task of economic, social and, to some extent, the environmental regeneration of the area. Various departments in the City Council were also active in this process, particularly in respect of its environmental value and potential. One of the key aspects of the valley's environmental reclamation was based around the concept of two linear corridors running east to west along this section of the valley and centred on the Sheffield to Tinsley canal and the River Don. 'Nodes' of sites of wildlife value would be linked by access routes and landscaping and would integrate the wildlife proposals into a leisure corridor (Rotherham and

Cartwright, 1986; Cartwright, 1986; Watts, Pearson, and Rotherham, 1987; and Sheffield Economic Regeneration Committee, 1987). Cartwright (1986) strongly highlighted the value of these wildlife sites for environmental education in an area which had previously been deprived of such resources. Two sites were specifically promoted and developed for such purposes:

* The Mill Race Ecology Park, which only had a limited period of use as no-one could be found to manage the site when the Sheffield Development Corporation ceased its function.
* Blackburn Meadows Nature Reserve, which has been far more successful and is the subject of a case study within this study.

Other significant developments were a phased development of the Five Weirs Walk, a riverside route through valuable wildlife habitat, and upgrading the canal towpath.

Figure 4.54 is a press article that warrants a degree of hope for the catchment.



Sheffield Telegraph, Friday, October 4, 2002

Quiet flows the Don

SALMON Pastures? It's doubtful whether the name will ever be appropriate again for any part of Sheffield bordering the River Don.

But a report this week indicates that urban rivers have started to catch up with their cleaner rural counterparts, and the Sheffield area is among the success stories.

Fish and wildlife are returning to the heart of the city now that once heavily-polluted waterways have been cleaned up.

The other week participants in an urban walk alongside the River Don at Lady's Bridge watched kingfishers darting along the river bank.

In fact, the River Don has seen some of the most dramatic improvements in water quality, especially below the Blackburn Meadows sewage treatment works, says the Environment Agency, which published this week's report.

In 1990 the river was classified as "bad" and in 1995 it was "poor". Today it is "good" above the sewage works and "fairly good" below this point.

The Environment Agency says the positive results are mainly due to "massive" investment by water companies in sewage treatment, which means cleaner discharges into the river.

"If you talk to the anglers they will say that the River Don through Sheffield all the way to Doncaster is becoming one of the best coarse fisheries in the area," said Jill Credland, team leader in environmental management.

Species such as chub, dace, roach and barbel can be found. And insects such as stoneflies and mayflies can now be seen in the centre of Sheffield.

Rivers had also been cleaned up on the outskirts of the city thanks largely to new water treatment plants and tighter restrictions on companies which discharge into the water.

"We are now concentrating on the tributaries of the Don, the urban streams," said Ms Credland. "They can be quite badly affected by storm overflows. We are pushing very hard to encourage the water companies to invest further in improvements."

According to the Environment Agency, rivers running through cities and towns – historically polluted by industry, sewage overflows, road run-off and domestic plumbing misconnections – are showing something of renaissance, although figures still show that around one in eight urban rivers are categorised as 'poor' or 'bad'.

Local environmental campaigner Pete Bowler said of the situation in Sheffield: "Yes, there are improvements. I think we are getting to the stage where we are cleaning up the majority of the effects of the Industrial Revolution, but we shouldn't be complacent.

"It is not uncommon to see heron at the water's edge such as on the Five Weirs Walk. Almost anywhere, if its fairly quiet, you will see herons waiting to catch the fish that have returned as part of the improvement in river quality."

Quite often rainbow trout and a few brown trout, roach and perch can be spotted in the city centre, he added. Grey wagtails, kingfishers and occasionally dippers are also being attracted.

The decline of steel and mining are among the reasons for the cleaner rivers, said Mr Bowler. "The quality of the rivers has improved an awful lot, but we are still a long way off getting them back to the way they were prior to the Industrial Revolution."

In the early 18th century, salmon was so plentiful that apprentices working at mills at Salmon Pastures in the East End used to complain about being fed it three times a week.

Despite the significant improvements over the past 10 years or so, they wouldn't find any salmon in Sheffield's rivers today.

Figure 4.54: Press article relating to improvements to the water quality of the River Don.

4.13 Summary of findings.

In relation to wetland perception, functions and processes in the River Don catchment various patterns begin to emerge. The first is a pattern of 'what might have been' in relation to the geomorphology of the catchment. This chapter has described the changing nature of the landscape from the headwaters of the main river system on the high moorlands to the west to the flat plains in the lowlands to the east. Not only does altitude and climate dictate differing habitat types, but diversity is also provided through changing underlying geological and soil characteristics.

Many of these differing habitat types still survive but the chapter has also described a pattern of observable historical landscape change through human influence. Through this there is a recognised progressive historical decimation of water and wetland features in the catchment, particularly through a rapid progression of industrialisation (through technological advancement and innovation) in the nineteenth and early twentieth centuries. Alongside this was a rapidly increasing population with associated land use change for settlement development. Both industrial development and population increase had significant detrimental effects on water quality within the river system (and thus also with its associated wildlife).

Other human-induced landscape changes from the same period are also evident in terms of land drainage for agricultural 'improvement' in the east of the catchment alongside major engineered changes to the river corridor as part of this 'enhanced' drainage, for river navigation and for flood control. Firth (1977) goes as far as to say that the wetland destruction brought about by the drainage of the lower part of the Don catchment would today be seen as an ecological disaster of huge proportions. In the western uplands major landscape changes were brought about through use of land alongside the rivers to provide reservoirs for potable water and as compensation tanks to maintain river flows for industrial use in drought periods.

Not all these changes are seen as negative. For instance, not only are reservoirs essential for maintaining human existence in the region, but they are often perceived as adding to its landscape beauty and providing several recreational opportunities. In the chapter the possibility of restoring the channel of the Don to re-establish salmon spawning 'runs' was raised. This seems an admirable aspiration but could well attract objections in relation to the necessary destruction of whole or part weirs, thus destroying a significant part of the region's industrial heritage.

In nature conservation terms the changes can also provide diversity. Mining activity has, in places, resulted in the collapse of mine 'galleries' thus creating surface depressions which often fill with water and become subsidence 'flashes' which become valuable wildlife sanctuaries. Examples of these can be found at Broomhill Flash in the Dearne catchment and Catcliffe Flash in the Rother catchment. Industrial buildings and their adjacent 'wastelands' have also provided habitat for species not normally expected in the catchment. For instance, black redstart (*Phoenicurus ochruros*), normally found on mountain crags in mainland Europe, could be found nesting and feeding around the steelworks of Sheffield in the 1970s and 1980s.

A pattern has also emerged of observable post-industrial decline and the decimation of the major economic functions of the region (e.g. steel manufacture, engineering and coal mining). This has resulted in large tracts of derelict land that have become the target of regeneration projects. The late twentieth century saw a 'sea change' in attitudes of planners towards the value of pleasant environmental settings for new development. Thus environmental projects such as Blackburn Meadows nature reserve alongside the Don in Sheffield and Old Moor nature reserve in the Dearne catchment were seen as key projects within the overall social and economic regeneration of former industrial areas.

The Don catchment is ripe for more regeneration projects but the question is as to where nature conservation initiatives fit into this progression. It is now accepted that such projects can act as a backdrop and encouragement to economic and social regeneration and so consideration must be given to their ecological requirements. *Chapter 5* examines the role of environmental projects in regeneration schemes in the context of corridor theory. The river system provides a natural series of linked corridors of which schemes, such as Blackburn Meadows and Old Moor, and the other case study projects described in *Chapter 8*, are important nodes of nature conservation investment within the corridor system. But there is a need for a strategic overview of how a network of sites can complement and interact with each other to ensure their success, and how the region's diversity of wetland habitats can be enhanced. Corridor theory is also subject to much debate and it is recognised that there are also negative effects in these linkages.

A further benefit of industrial decline has been a corresponding enhancement of water quality within the river system with all the rivers now supporting fish populations and thus providing a significant contrast to the view of the Don and Rother in the 1970s and 1980s of being the second worst polluted rivers in Europe.

There is also an emerging pattern of potential future change. Climate change is more and more seen as a reality that will affect the region in the near, as well as the far, distant future. The Environment Agency seem to be taking this more seriously and the major floods in the early twenty-first century have led to significant changes in strategic planning for flood defence on a national basis and this is discussed in more detail in *Chapter 7*. No longer is it suggested that the best way of dealing with excess water is to channel it as fast as possible to the sea and to flood some places at the expense of others. Now the benefits of natural storage of water in the undrained 'sponges' of the peat bogs in the upper catchment and the containment of excess water in the floodplains and washlands of the lower catchment are seen to be more viable and more acceptable. Thus it is expected that large areas of currently farmed low-lying land will be compulsorily purchased for such containment areas. *Chapter 9* reviews a series of interviews

with key personnel in the region, one of whom is employed by the Environment Agency. He suggests that, in a regional context, these new flood containment areas could be designed to provide significant areas of created, diverse wetland habitats.

Changes in agricultural practices and strategy and policy relating to this (discussed in *Chapter 7*) will probably result in land becoming available for other purposes and/or for less intensive management and will thus benefit the regional diversity of wetland habitats. Diversification initiatives in the region may well result in multiple purpose strategies along river corridors that could be enhanced by greater promotion of tourism and recreational opportunities. The planning for the Humberhead Levels demonstrates the potential for such opportunities. A network of nature conservation developments could well be a significant factor in such projects.

Within the catchment network described priorities must be made as to where sites are targeted and resourced. *Chapter 5* examines theories of site location, selection and interconnection.

5.0 THE IMPORTANCE OF WILDLIFE CORRIDORS AND RESERVE NETWORKS IN SITE SELECTION – AN OVERVIEW OF THE LITERATURE.

5.1 Introduction.

In *Chapter 4* the processes and functions that have affected the riverine environment of the River Don together with its associated wetlands have been described in detail. The Don and its tributaries are essentially corridor systems with existing, occasional 'nodes' of nature conservation and/or recreational interest. With the loss of major industries there is a significant amount of available land along the flood plains of the valleys where the industries were once located. The initiative is to redevelop these areas to provide social and economic rejuvenation. With so much land available in these corridors the potential exists to enhance or create areas of nature conservation interest that in return will provide a 'green' backdrop that encourages industry to locate to the region. As these sites are in flood plain situations the obvious habitats will be of a wetland character. Underlying principles to the criteria for identifying sites of nature conservation interest that have the potential to stimulate economic and social regeneration will now be examined.

Bennett (1998) suggests that habitat fragmentation is a dynamic process with three main components of an overall loss of habitat in the landscape, a reduction in the size of the remaining blocks, and increased isolation by new forms of land use. Changes to the pattern of habitats in the landscape results in changes to ecological processes which in turn can affect the status of the fauna and flora of these habitats.

Linear features are very evident in the human-dominated landscape. Spellerberg and Gaywood (1993) outline a history of human impact on the terrestrial and aquatic environments that has resulted in an uneven, diverse landscape which is made up of artificial features and remnants of semi-natural habitat. They suggest that urban landscapes can be equally heterogeneous. For some plants and animals the patchy and fragmented nature of these habitats makes it difficult for them to disperse. They suggest that there is a possibility that linear habitats could well act as dispersal corridors between the fragments as well as important wildlife habitats in their own right.

Weddell (2002) suggests that the term 'corridor' can encompass several understandings of its application. She states that it has been used to define linear strips of habitat that physically

connect reserves, or as a series of 'stepping stones' which are not directly linked but provide discrete patches e.g. along a migratory bird route, *etc.*

5.2 The concept of island biogeography with linkages by corridors.

Island Biogeography Theory (MacArthur and Wilson, 1967) attempts to identify the processes which underlie equilibrium in species numbers on any island and has developed from studies of the fauna and flora of maritime islands and the effects of distance from shore (isolation) and island size on these communities. In general, immigration rates are predicted to increase and extinction rates decrease on larger, more accessible islands yet the opposite is likely to be true on smaller, more isolated ones. In summary, there are three recognised patterns where larger islands tend to support more species; remote islands tend to support fewer species; there is a turnover of species on islands, with newcomers replacing other species that became extinct (Kendle and Forbes, 1997).

Kendle and Forbes (1997) go on to describe features of these 'islands' (**Figure 5.1**).

Features of biogeographic 'islands':

* large islands are likely to consist of a wider range of habitats that will support more species;
* the smaller the range of habitats the more likely species that arrive will be vulnerable;
* large islands may support larger populations of given species reducing the risk of extinctions;
* the larger the island the less chance events like fire or flood will decimate populations.

Figure 5.1: Features of biogeographic 'islands'.

This island concept can be used in the context of both rural and urban settings. In urban areas formal and informal greenspace represents the islands and the developed areas become the ocean. In rural areas the islands would be pockets of semi-natural habitat surrounded by the 'ocean' of improved pastureland or arable crops. The recurring theme from what research has been done, is that habitat size is a major factor accounting for differences in species richness and diversity (Dawson, 1994; Spellerberg and Gaywood, 1993).

Kendle and Forbes (1997) indicate that one of the main applications of MacArthur and Wilson's (1967) theory is in the planning of terrestrial nature reserve designations and management if they are surrounded by land that is a hostile environment to the species within the reserve. The proximity of related habitat may allow species movement but fragmentation of habitats which increase dispersal distance will lead to a reduction in species numbers that can be supported in these isolated areas. Corridors and habitat links between reserves help to reduce the isolation and vulnerability of species (Kendle and Forbes, 1997; Adams and Dove, 1989; Rich, 1994; Bennett, 1998).

So each urban or rural area can be a series of habitat islands which can be considered individually or as a collective system. The viability of these habitat islands is often dependent on the ability of fauna and flora from outside to colonise or utilise the area. Thus the spatial arrangement of the islands, the linkages between them and the linkages to rural surroundings are crucial. However, it is easy to look at these interrelationships at a very simplistic level as individual areas, perhaps of very different habitat-types, that can be linked by corridors of equally variable habitat-types. Some species can be highly specialist in habitat requirements and therefore it could be totally unsuitable for movement of these species, and thus act as a barrier rather than an interconnection. Consideration should also be given to the preservation of regional diversity with an emphasis not on the total number of species present but on which site contains species that would become extinct if that refuge were not present. Also, ideally a corridor is not purely a linear link of 'green' but one that has graded tiers alongside to act as buffer zones. It will also be habitat in its own right, particularly in the case of riparian corridors (Adams and Dove, 1989). But as Kendle and Forbes (1997) suggest, the significance of the quality of the landscape of such connections is paramount to the movement of species along them. But corridors may also be the foci for predatory species (Jarvis, 1990). Thus corridors linking reserves significantly increase species presence and diversity but only if dispersal ability is the limiting factor. Other factors include habitat diversity, physical characteristics such as drainage, soils, *etc*, and management issues such as disturbance. However, corridors are rarely homogenous with adjacent habitat-types or in terms of structures within corridor system e.g. a river with riffles, pools, open/shaded areas, gravel beds, silt, deep and slow flowing, fast and shallow, etc. But there are also negative ecological factors associated with corridors. These include spread of fire, spread of disease, and spread of alien species. Despite the fact that rivers and streams are often modified for human purposes they tend to be the only linear feature in a 'natural' landscape. It is clear that river corridors with their variety of edge habitats and in-stream variety of conditions, act as recognizable corridors**. Figure 5.2** is a diagrammatic representation of a stream which illustrates four main functions of a linkage in the landscape.

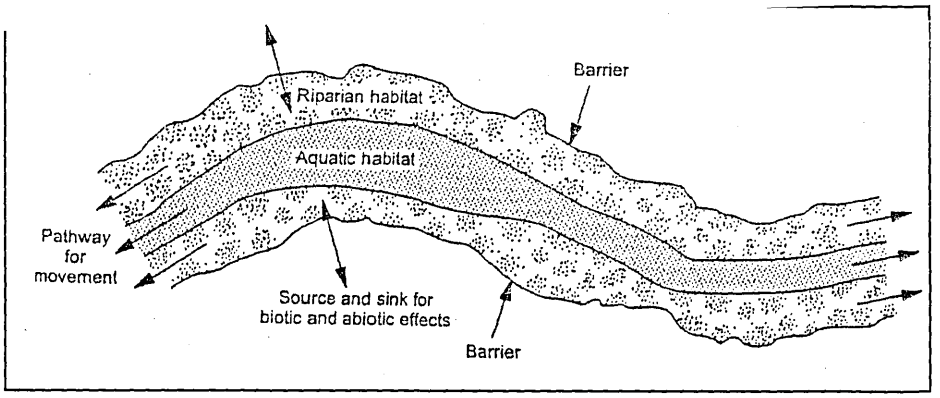


Figure 5.2: Diagrammatic representation of a stream which illustrates four main functions of a linkage in the landscape. The riparian and aquatic zones: (i) provide a habitat for plants and animals; (ii) provide a pathway for movement of animals through the surrounding environment; (iii) pose a barrier or filter to the movements of certain animals; and (iv) are a source and sink for interactions with the surrounding environment. (Source: Bennett, 1998, p44).

Associated wetlands and water bodies close to, the riparian corridor could be classed as habitat 'nodes' which 'feed' the linear linkages. In this setting examples of such 'nodes' might be nature reserves associated with major landscape links or flood plain expansions along riparian corridors. (Bennett, 1998). The case study sites which are described later in the study fulfil this role. There can also be associated recreational, educational, transport, heritage and landscape importance associated with all these classifications and which take on greater significance in urban areas (Spellerberg and Gaywood, 1993). Dyduch-Falniowska (1998) suggests that linking islands of high natural value with linear structures is logical within well preserved river valleys. 'Stepping stones' with linear linkages are likely to be an effective approach to maintaining landscape connectivity. Bennett (1998) gives reasons for this as shown in **Figure 5.3**.

Effectiveness of 'stepping stones':

* for species that move between different patches in the landscape e.g. for foraging;
* for species that are relatively mobile and able to move substantial distances in relation to the intervening distance between fragments;
* for species that are tolerant of disturbed landscapes;
* where the objective is to maintain continuity of ecological processes that depend on animal movements and the species are capable of movement across gaps.

Figure 5.3: The value of linking 'islands' of high ecological value. (Source: Bennett, 1998).

The ecological value of corridors is shown in **Figure 5.4.**

Corridors:

* facilitate movement, migration and dispersal hence:
  - increasing foraging territory in times of hardship
  - migration to seasonal breeding/feeding areas
  - ability of young to disperse and find territory and therefore prevent overcrowding and stress on foraging
  - movement assists in genetic diversity and gene flow

N.B. Dispersal of species not only requires the corridor but also the mobility to travel along it - flight, ambulatory movement or swimming. However, flight precludes the need for following a corridor although some corridor features are used as navigational aids.

Figure 5.4: **The ecological value of corridors.** (Source: Author).

Figure 5.5 shows the socio/political/economic benefits of well managed corridors and **Figure 5.6** the reasons why there is a key need to protect and create corridors and reserves in urban areas

Corridors can provide:

* A boost to regeneration;
* Aesthetic value;
* Health benefits
  - well-being,
  - air quality,
  - exercise
* Recreation opportunities;
* Relaxation value
* Biodiversity;
* Educational potential;
* Flood protection;
* Wastewater management.

Figure 5.5: **The socio/political/economic benefits of well-managed corridors.**

Reasons for protecting and creating corridors and reserves in urban areas:

* 'Green' corridors act as links to the wider countryside;
* 'Green' links between corridors provide connectivity;
* Desired green links with reference to the distance to people's houses are extremely important factors in terms of accessibility and need to be prioritised in terms of development issues.

Figure 5.6: **The reasons why there is a key need to protect and create corridors and reserves.**

5.3 Strategic planning for corridors and reserve networks.

Noss (1987) suggests that the continuing severance of natural linkages in many landscapes require active strategies to combat the process. He also stresses the multi-purpose value of such links in relation to quality of life features such as aesthetics, recreation, pollution abatement and land value enhancement. This is therefore an indication of the value of landscape linkages for both people and wildlife.

Bennett (1998) has suggested there is no uniform set of guidelines for the design and management of linkages. However Spellerberg and Gaywood (1993) outline how strategies for identification and management of linear habitats have become increasingly important in urban planning allowing provision for wildlife, recreation and development to co-exist. Because urban environments have the potential to provide many different kinds of linear habitat for a variety of purposes it is useful to classify linear habitats as shown in **Figure 5.7**.

Classification of wildlife corridors adopted by the Cleveland Wildlife Strategy.

a) Strategic Wildlife Corridors

These are open space corridors of particular significance on a county-wide basis. They are the longest of the wildlife corridors and sweep across areas of mainly agricultural land containing important wildlife sites. They indicate the major open passageways between, and into, the urban areas.

b) Local Wildlife Corridors

As the name suggests, these form a more localised corridor network linking rural and urban areas within and between each district. They consist mainly of urban greenspace together with important wildlife sites but on a smaller scale than their strategic counterpart to which many of them are connected. The close proximity of these corridors to the urban areas of Cleveland means they are of considerable importance.

c) Wildlife Links

These are narrower than local wildlife corridors but in many cases longer, as they include man-made features such as railway embankments, disused waggonways, road verges, pathways and natural features such as streams. These help form an intricate web for the movement of people and wildlife throughout the county.

Figure 5.7: **Classification of wildlife corridors adopted by the Cleveland Wildlife Strategy.** (Source: Spellerberg and Gaywood, 1993).

Sheffield's Nature Conservation Strategy has similar classifications and these are underpinned by relevant policies and stated initiatives examples of which are given in **Figure 5.8**. Barker (1984), suggests elements that should be in any strategic plan in **Figure 5.9**. However, it should be noted that there is still considerable debate about the value of corridors for wildlife dispersal.

Policies

The network of Green Corridors and Green Links will generally be:-

a) Protected from development which would detract from their predominantly green and open character;

b) Enhanced by encouraging development and land management changes which increase their wildlife value;

c) Extended by seeking to create new greenspace in the areas of Desired Green Links.

Initiatives

* Redevelopment opportunities in relation to landscaping and riverside access;
* De-culverting of streams and rivers where possible;
* Creation and management of 'stepping stones' e.g. lakes, ponds, nature reserves, parks, 'wasteland', etc.;
* Habitat management.

Figure 5.8: Policies and initiatives from Sheffield's Nature Conservation Strategy. (Source: Bownes *et al..,* 1991).

Conservation elements that should be in any strategic plan:

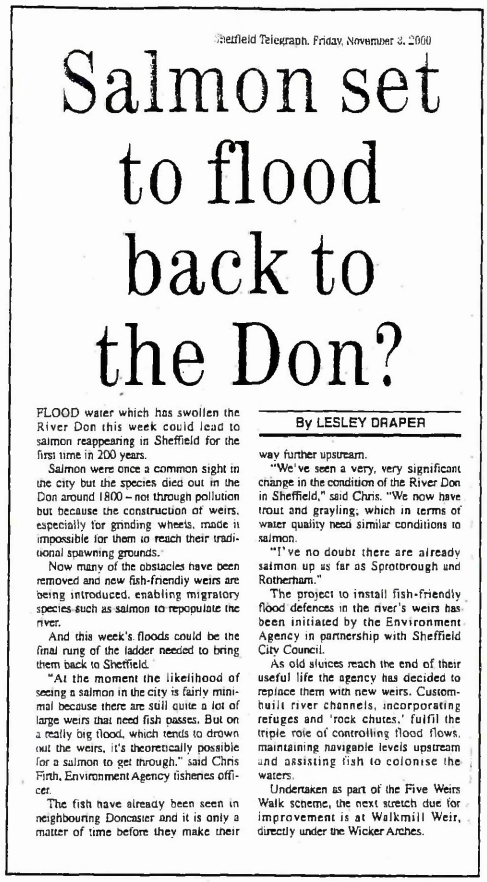
* identification of the main reservoirs of wildlife by systematic survey;
* identification of the main corridors for wildlife in the built-up area;
* identification of key linkages between different reservoirs and corridors;
* protection and enhancement of the above;
* identification of the main areas where semi-natural habitats are not available to people;
* policies aimed at improving these areas of need;
* policies aimed at ensuring that the public can enjoy wildlife in ways which are both responsible and informed;
* insistence on design standards for building development which make the most of opportunities to add to wildlife habitats and which cause the least possible damage to existing wildlife habitats throughout the whole built-up area;
* policies designed to encourage local initiatives to achieve all the above.

Figure 5.9: Conservation elements that should be in any strategic plan. (Source: Barker, 1984).

Spellerberg and Gaywood (1993) propose that, because biodiversity losses are now so serious, it is crucial to combine wildlife interests with other functions of linear habitats where possible. Bennett (1998) reinforces this in suggesting a need to maximize landscape connectivity by using habitats retained primarily for other purposes. He suggests that the effects of external disturbance of any linkage can be managed by zoning of land uses and the prohibition of certain types of land use close to important natural areas and the use of buffer zones around conservation areas to minimize the impact of external influences. However, he also outlines the difficulties that can be faced in maintaining networks of habitats and their ecological functions including lack of recognition of the ecological values of these features; lack of recognition of their context in the broader landscape; lack of coordinated management because they may extend across many parcels of land with different owners. (This is particularly so with rivers which will usually cross several administrative boundaries); incremental clearing and loss resulting in gaps in the network; and degradation of habitats due to edge effects and adjacent land uses.

Berry (2002) suggests that individual responses by species to climate change will lead to changes in community composition. At the site level she propounds that the loss of a species may have extensive implications for achieving existing conservation commitments, particularly if the species is the prime reason for the site's designation or if it forms an essential part of the protected habitat type. She also suggests that new buffer zones, ecological 'corridors' and 'stepping stone' sites should be planned to minimise climate stress on existing species and to develop new communities. So the emphasis in planning is likely to be on these linkages and particularly river corridors with existing riparian continuity - effectively river basin management. The 'nodes' of specific nature conservation sites, like the case study sites outlined in this project, will become increasingly important in these corridors.

In a local context the Don and its tributaries (as described earlier) were important for salmon spawning. Use of the river for industrial purposes resulted in the construction of weirs as water retaining features. In some cases these presented migrating fish with insurmountable barriers and, in association with gross pollution in the rivers, migrating fish ceased to use the rivers. There has been much discussion (**Figure 5.10**) whether the river system could again become a spawning area but this would result in huge investment to overcome the physical barriers of the weirs, and resultant damage to what are now considered to be features of Sheffield's industrial heritage.



Sheffield Telegraph, Friday, November 3, 2000

Salmon set to flood back to the Don?

By LESLEY DRAPER

FLOOD water which has swollen the River Don this week could lead to salmon reappearing in Sheffield for the first time in 200 years.

Salmon were once a common sight in the city but the species died out in the Don around 1800 – not through pollution but because the construction of weirs, especially for grinding wheels, made it impossible for them to reach their traditional spawning grounds.

Now many of the obstacles have been removed and new fish-friendly weirs are being introduced, enabling migratory species such as salmon to repopulate the river.

And this week's floods could be the final rung of the ladder needed to bring them back to Sheffield.

"At the moment the likelihood of seeing a salmon in the city is fairly minimal because there are still quite a lot of large weirs that need fish passes. But on a really big flood, which tends to drown out the weirs, it's theoretically possible for a salmon to get through," said Chris Firth, Environment Agency fisheries officer.

The fish have already been seen in neighbouring Doncaster and it is only a matter of time before they make their way further upstream.

"We've seen a very, very significant change in the condition of the River Don in Sheffield," said Chris. "We now have trout and grayling, which in terms of water quality need similar conditions to salmon.

"I've no doubt there are already salmon up as far as Sprotbrough and Rotherham."

The project to install fish-friendly flood defences in the river's weirs has been initiated by the Environment Agency in partnership with Sheffield City Council.

As old sluices reach the end of their useful life the agency has decided to replace them with new weirs. Custom-built river channels, incorporating refuges and 'rock chutes,' fulfil the triple role of controlling flood flows, maintaining navigable levels upstream and assisting fish to colonise the waters.

Undertaken as part of the Five Weirs Walk scheme, the next stretch due for improvement is at Walkmill Weir, directly under the Wicker Arches.

Figure 5.10: **Press article relating to the feasibility of the Don and its tributaries once again becoming salmon rivers.**

5.4 Summary of findings.

This chapter has not tried to produce a definitive statement about the importance of corridors and their functions as it is recognised that there is considerable flux in the debate regarding the evaluation and study of corridors, their associated landscape ecology and the concept of island biogeography which questions their importance and their functions (see Dawson, 1994). Of concern are the negative aspects of corridors in that they can aid the spread of fire and disease, and a current particular issue is the ability of corridors to provide a conduit for the spread of invasive species. Many banksides of the river Don are covered in dense thickets of Japanese knotweed (*Reynoutria japonica*) and, to a lesser extent, Himalayan balsam (*Empatiens glandulifera*).

The findings of the research in relation to wetland perception, functions and processes suggests that, subject to the qualifications indicated above, the theory of the existence of corridors with nodes of nature conservation interest is an ideal strategic planning format for development that

complements social and economic regeneration in the Don catchment. Thus the river system provides 'natural' corridors on which strategic planning, and subsequent project development, can be applied. They are also significant as corridors in recreational terms.

Chapter 6 provides a methodology for deeper investigation of the study's precept within the Don catchment.

6.0 METHODOLOGY.

6.1 Introduction.

Pettigrew (1985, cited in Gill and Johnson, 1991) describes the research process as best characterised as 'muddling through' in an incremental and political process rather than as rational, foresightful, goal-directed activity. Yet the definition of methodology would indicate that it is the *logic* of selection and de-selection of chosen methods of investigation alongside the individual preferences of the researcher.

Blaxter, Hughes and Tight (1996, p. 16) suggest that:

".....research should be as open and transparent as possible in terms of its intentions, methodology, analysis and findings."

The previous chapters have outlined the purpose, aims and objectives of the research study and set it in the context of a situational analysis relating to the issues and trends surrounding the topic area. This chapter will now detail how investigations will be carried out to support or refute the research questions and to lead into a later evaluation and discussion of potential future action.

Hart (1998) describes methodology as being a system of methods and rules to facilitate the collection and analysis of data, suggesting that it provides the starting point for choosing an approach made up of theories, ideas, concepts and definitions of the topic. It is the basis of a critical activity where choices are made about the nature and character of a topic area. Neuman (1994) tells us that, in simple terms, research is a way of going about finding answers to questions. Easterby-Smith, Thorpe and Lowe (1991) suggest that research design is more than simply the methods by which data are collected and analysed proposing that it is important that there is an overall configuration of a piece of research, that it describes what kind of evidence there is and where it comes from, and how such evidence is interpreted in order to provide good answers to the basic research question. Robson (2000) describes this in an analogy to the role of a detective who will watch people or situations to try to work out what is going on (observation); ask people about it (interviews, questionnaires, tests); and look for evidence that is left (documents, *etc.*).

It is the aim of this study that the research design will provide the basis for Bell's (1997) requirements for a successful study where the reader is provided with a three-dimensional

picture which illustrates relationships, micro-political issues and patterns of influences in a particular context.

6.2 Research strategy.

Whilst it is too simplistic a dichotomy to accept that quantitative and qualitative research methods are isolated from each other this research study does not lend itself easily to quantitative data collection and analysis. Weddell (2002) suggests that the real world is more complex and less predictable than the laboratory and does not always lend itself to experimental manipulation. During the late 1960s and through the 1970s qualitative methods of research began to emerge as a new, critical form of inquiry to reveal qualities of life and the perspective of those experiencing the research setting. As stated in the chapter *'Setting the Scene'*, the basis of the research study is the concept that:

1. **Wetland management, enhancement and creation (all aspects of restoration and rehabilitation) may present significant opportunities as a platform for regeneration and for balancing former environmental loss and degradation.**

2. **Wetland restoration projects are critical in facilitating social and economic regeneration at local and regional levels.**

The terminology and key words such as *'environmental'*, *'economic'* and *'social'* which are used in these statements indicate the nature of a complex mix of data often gathered in different ways. However, Rudestam and Newton (2001) suggest that criteria for a good hypothesis should be free of ambiguity, that it will express the relationship between two or more variables and that it will imply empirical discovery. With a sound starting point the research should formulate theory which may indicate missing ideas or links and the kinds of additional data required. This theory development is an essential tool of research which stimulates advancement of knowledge in the subject area (Bell, 1997) and/or provides insight into issues from which recommendations for change can be made. However, Neuman (1994) identifies concepts as containing built-in assumptions about the nature of things that are neither observable nor testable and, if these are based on sound experience and knowledge, then they can be accepted as a necessary starting point.

Veal (1992) shows that description and explanation are integrally linked in a research circle in which the gathering of information will form a description which is then expanded into explanation and understanding of that information. The understanding may identify the need for

more information and so the circle continues, but with greater depth of detail each time. Miles and Huberman (1994) suggest that qualitative reports should:

* communicate a clear sense of the historical and social context of the study settings;
* demonstrate how key concepts have emerged over time, which variables have appeared/disappeared, what important insights have developed through the process;
* provide focussed, basic data allowing the reader to draw warranted conclusions.

The central data-gathering techniques of this qualitative research approach are observation and unstructured interviewing (Burns, 2000) but these are underpinned by detailed investigation of subject-specific literature and documentary sources. The strength of qualitative research is found in a study that is descriptive or exploratory or explanatory, and that stresses the importance of context and frames of reference. Hart (1998) explains that exploratory research can provide better understanding and illumination of a process or problem. He suggests that descriptive research can promote understanding of an issue by observing the details of what makes it an issue in order to provide a basis for valid argument. He describes explanatory research as being capable of explaining a cause or non-occurrence of a situation, showing causal connections and relationships between variables, and the possibility of making recommendations for change. Neuman (1994) proposes that explanatory research will have the outcomes outlined in **Figure 6.1**.

Explanatory research will:

* determine the accuracy of a principle or theory;
* suggest which competing explanation is better;
* advance knowledge about an underlying process;
* link different issues or topics under a common, general statement;
* build and elaborate a theory so it becomes more complete;
* extend a theory or principle into new areas or issues;
* provide evidence to support or refute an explanation.

Figure 6.1: **The outcomes of explanatory research.** (Source Neuman, 1994).

Robson (2000) suggests that a large proportion of 'real world' research includes an initial exploratory phase of documentary research and consultation to discover the contexts and mechanisms that are most appropriate. He also suggests that more than one mechanism may be involved and whether these operate or not depends on the context. Veal (1992) points out that it is not possible to develop hypotheses and theories without some initial information or knowledge of the subject area and that this might arise from informal observation and experience of the researcher or from existing literature. In this particular study the author has a well-developed and intimate knowledge of the topic area which aids the formulation of proposals for the mechanisms and contexts that are likely to be relevant. This focuses the research but, in interpretation of ongoing data collection, also allows investigation of avenues of investigation which were not initially obvious. To facilitate this the research strategy has to remain as an evolving and flexible design. Robson (2000) clearly indicates the validity of such an approach because of the detail that is acquired through interaction with the subject, the people involved and the nature of how data collection and analysis become intertwined. Becker (1965) cited in Gill and Johnson (1991) concludes that no matter how carefully the research is planned in advance, it will be designed in the course of its execution. Denscombe (1998) describes this process as a trail of discovery where each new phase reflects what has been discovered so far but also indicates new angles of investigation and new avenues of enquiry. For example, an interview with a key player in the subject area may indicate a need to interview others. **Figure 6.2** shows a comparison of qualitative and quantitative methods of investigation.

Qualitative	**Quantitative**
Assumptions	
Reality is socially constructed.	Facts and data have an objective reality.
Variables are complex and inter-woven – difficult to measure.	Variables can be measured and identified.
Events are viewed from the informant's perspective.	Events are viewed from an outsider's perspective.
Dynamic quality to life.	Static reality to life.
Purpose	
Interpretation.	Prediction.
Contextualisation.	Generalisation.
Understanding the perspectives of others.	Causal explanation.
Method	
Data collection using observation and unstructured interviews.	Testing and measuring.
Concludes with hypothesis and grounded theory.	Commences with hypothesis and theory.
Emergence and portrayal.	Manipulation and control.
Inductive and naturalistic.	Deductive and experimental.
Data analysis by themes from descriptions.	Statistical analysis.
Descriptive write-up.	Abstract, impersonal write-up.
Role of researcher	
Researcher as instrument.	Researcher applies formal instruments.

Figure 6.2: **Comparison of qualitative and quantitative methods of research.**
(Adapted from Burns, 2000).

Denscombe (1998) lists the advantages and disadvantages of qualitative research in **Figure 6.3** overleaf.

Advantages of qualitative research.

* Data and analysis are grounded in reality;
* There is a richness and detail to the data resulting from focussed areas of interest;
* There is tolerance of ambiguity and contradictions which is not a reflection of weak analysis but a reflection of the reality of what is being investigated;
* There is the prospect of alternative explanations.

Disadvantages of qualitative research.

* Data may be less representative and not easy to generalize from;
* Interpretation of data may be affected by the researcher's own identity, background, experience and beliefs;
* There is a possibility of de-contextualizing the meaning by separating the words used from the context of the situation;
* There is a danger of oversimplifying the explanation and of disregarding data that does not 'fit'. Inconsistencies, ambiguities and alternative explanations can inhibit clear generalizations.

Figure 6.3: Advantages and disadvantages of qualitative research. (Source: Denscombe, 1998).

Neuman (1994) suggests that exploratory researchers frequently use qualitative research techniques because they tend to be more open to using a range of evidence and discovering new issues. The goals of exploratory research are described in **Figure 6.4.**

The goals of exploratory research are:

* Become familiar with the basic facts, people, and concerns involved.
* Develop a well-grounded mental picture of what is occurring.
* Generate many ideas and develop tentative theories and conjectures.
* Determine the feasibility of doing additional research.
* Formulate questions and refine issues for more systematic inquiry.
* Develop techniques and a sense of direction for future research.

Figure 6.4: Goals of exploratory research. (Source: Neuman, 1994)

6.3 Research methods.

This study was initiated as a topic to explore and in its process has identified issues that require explanation. Beard and Parr (1999) promote the idea of research consisting of a rich and complex mosaic of differing research approaches, and in the process of carrying out these different approaches, the validity and reliability of any conclusions will be enhanced.

To attempt to achieve these ideals this study has used a combination of critical evaluation of key documentation, focused interviews with key personnel, and comparative information from case study wetland projects within the catchment. These will be described in greater detail later in the chapter. This variety of research methods used aims to describe the situation with its opportunities and constraints, and to assess the future in the context of its setting. It is believed that, as Robson (2000) and Hakim (1987) point out, several methods of enquiry are likely to be better than any single one in shedding light on an issue. In this way the level of detail in the data will be much richer allowing more confidence in the discussion and conclusions that will result from their analysis. In effect, this means that the topic area is 'seen' from the different data perspectives providing an alternative view of the research problem.

The research methods used reflect the nature of the research enquiry. Denscombe (1998) discusses the fact that qualitative research methods appear to compete with each other but he argues that they can also be complementary, combining to produce differing but mutually supportive data. He points out that each method provides its own distinctive perspective and each approaches the collection of data with a certain set of assumptions. Of the data collected each method produces its own inherent strengths and weaknesses in relation to the aims of the study. The data collected will not necessarily be on the same thing but can be used to compare and contrast thus improving the quality, depth and breadth of the research and consequently enhancing its validity. In essence this allows the use of 'triangulation' in any analysis which he describes as finding the 'truth' from different reference points. As Robson (2000) points out it is necessary to introduce rigour into all aspects of enquiry to achieve a justified credibility and trustworthiness. Gill and Johnson (1991) describe this as convergent validation.

In making decisions on the methods to be used Morse (2000) provides guidance on how this can be achieved. He suggests that the features shown in **Figure 6.5** are key to the decision-making process.

Key features of decision-making for choice of methods:

* identifying the scope of the topic area – the broader the scope the greater the breadth of investigation and the longer it takes;
* considering the nature of the topic – if it is obvious and clear then fewer sources are required;
* considering the quality of the data required – 'rich' data requires fewer sources;
* considering the time and resources available for the study.

Figure 6.5: Key features of decision-making for choice of methods. (Source: Morse, 2000).

Development of the research questions for this study has examined the strategic issues of a topic area effectively using the River Don catchment as a case study. In doing this there is the potential for transference of the outcomes of analysis and discussion to other areas within Britain and possibly into scenarios within mainland Europe. Equally, issues and developments in river catchments elsewhere in those regions can inform this research study. In effect a hierarchy of case studies has been examined as part of the research into the River Don catchment umbrella case study. This has included examples of local initiatives within the catchment and has referred to examples of initiatives from major catchment areas in mainland Europe. Weddell (2002) suggests that, in such circumstances, it is possible to use data from similar sites (but ones which also have some differences) to make a comparative study and identify any governing, or influencing, factors.

As one of the critical elements of the study relates to the presence or absence of strategic catchment planning then existing policies and strategies relating to the study have been examined and discussed as an integral part of the research strategy. Documentary evidence from key strategic sources has been a crucial element of the process of analysis through triangulation. However, a developing insight that has come to light in the course of the investigation has been a lack of knowledge or commitment or resources on the part of those who are charged with implementing such policies and strategies. This has been investigated through the use of focused interviews with key personnel in the public, private and voluntary sectors having conservation interests. In more detail the case for the research methods chosen is outlined.

6.3.1 Documentary evidence.

There is a plethora of documentation relating to policies, strategies and legislation associated with catchment management, river basin initiatives, water use, water quality, and the conservation of wetland/riverine habitats and species. These originate from international agreements and designations, European Union Directives, UK government policies strategies and legislation, regional guidance and local initiatives. Alongside these are published consultation procedures associated with the implementation of them. Major players in these discussions are government departments (such as the Department of the Environment, Food and Rural Affairs [DEFRA]) and government agencies (such as the Environment Agency). Each is very active in consultations, particularly because of the implications of the European Union's Water Framework Directive and the huge responsibilities to protect life and property against flood occurrence as a result of changing climate and exemplified by the major floods of Autumn 2000. Denscombe (1998) suggests that publications emanating from government sources provide information which is authoritative and objective although there may be vested interests. He states that they can also be factual, reflecting no ambiguity but can be based on people's decisions and judgments. The advantages and disadvantages of using documentary evidence as a research method are shown in **Figure 6.6**.

The advantages/disadvantages of using documentary evidence as a research method:

Advantages.

* There are vast amounts of available data and there is relatively easy access to it. (Denscombe, 1998)
* There is a relative permanence to the data which is open to public scrutiny. (Denscombe, 1998)
* Documents may specify events and issues in greater detail than interviews can. (Burns, 2000)

Disadvantages.

* It is difficult to assess the credibility of the source on occasions. (Denscombe, 1998)
* It is secondary data which is not necessarily produced to meet the specific aims of the study. (Denscombe, 1998)
* The data can often owe more to the interpretations of the authors than to an objective picture of reality. (Denscombe, 1998)

Figure 6.6: Advantages and disadvantages of the use of documentary evidence.

Other major sources of such documentation are voluntary sector organisations such as the Worldwide Fund for Nature (WWF) and the Royal Society for the Protection of Birds (RSPB) who are both actively involved in consultancy work, lobbying and consultations on wetland issues. Local authorities also produce a diverse selection of policy documents.

Clearly great care must be taken in the use of documentation within the study. Denscombe (1998) stresses that not all documentary sources are equally valid and that documents need to be assessed in terms of the quality of the ideas and information they contain. He goes on to address issues of evaluation of documentary sources, particularly focusing on some of the disadvantages listed in **Figure 6.6** above. He suggests the need to evaluate various aspects relating to the source as shown in **Figure 6.7**.

Is the source:		
* Authentic		
* Credible	-	is it accurate?
	-	is it free from errors?
	-	what purpose was the document written for?
	-	who produced it? what is their status? is there any history of bias?
	-	is it a first-hand report?
	-	what was the socio-political context and climate at the time of writing?
* Representative	-	typicality?
	-	completeness?
	-	is it edited or peer-reviewed?
	-	will any extract taken be in context?
* Has it meaning	-	clear and unambiguous?
	-	are there any hidden meanings?

Figure 6.7: **Ways of evaluating the source of data.** (Source: Denscombe, 1998).

Weddell (2002) reinforces this by suggesting that all historical documents reflect the recorder's biases about what was important at the time. But, as Denscombe (1998) suggests, analysis of such documentation provides signposts for the reader about where the research is originating from. It identifies which theories and principles have influenced the shape of the approach adopted and clarifies the key issues, the crucial questions and any obvious gaps in knowledge. These factors have been used in this significant element of the research strategy.

6.3.2 Case studies.

Within the overall context of the River Don catchment case study the element of strategic policy implementation has been examined through case studies on two levels. The first will refer briefly (with more detail in **Appendix 1**) to initiatives on the Rivers Rhine and Danube where significant developments have taken place to look at conservation needs alongside economic and social considerations. This data has been extracted from available documentary sources and through personal communications. The second level of case studies has looked at a selection of local initiatives within the River Don catchment to assess how they are aligned with strategic thinking, at issues associated with their development (such as resources and funding), at issues associated with their management and at their socio-political and economic reality and potential. These studies draw on work already done by the author and colleagues on these sites, on personal communications, on personal observation and involvement, and on documentary sources.

The justification for the use of such case studies lies mainly in the fact that such relatively small-scale initiatives will always be the reality of implementation of grander policies and strategies. The reasons why these projects have developed, the success or failure of how they have been managed and their future prospects will dictate the success or failure of policy implementation. In academic terms this research method is supported by the fact that, as Burns (2000) states, they are so intensive that they generate rich, subjective data which can bring to light variables, phenomena, processes and relationships that deserve more investigation. This additional research provides much greater depth, breadth and insight to the study. They also provide a vehicle for discussion on possible generalizations, comparisons and contrasts from which more meaningful suppositions can be made. Yin (1994) and Burns (2000) both place great emphasis on the 'real life' context of the case studies and the fact that they are an ideal vehicle for empirical investigation of particular contemporary phenomenon using multiple sources of evidence.

Robson (2000) describes a case study as shown in **Figure 6.8**.

A case study is:

* a strategy i.e. a stance or approach using multiple methods of investigation;
* being concerned with research and including evaluation;
* empirical in the sense of relying on the collection of evidence about what is going on;
* being about the particular – a study of that specific case and how that can provide generalizations, comparisons and contrasts with other sites;
* being focussed on a phenomenon in context.

Figure 6.8: **Features of a case study.** (Source: Robson, 2000).

Miles and Huberman (1994) remind us that a 'case' always occurs in a specified social and physical setting and thus cannot be studied devoid of its context. Burns (2000) suggests that to qualify as a case study it must be a 'bounded' system – an entity in itself that can be viewed as either very representative or atypical. Denscombe (1998) accepts that a small number of case studies can be selected from a large number of possibilities but that each must have clear justification for inclusion. Within this justification it should be asked;

* how representative is the case?
* are the findings likely to be unique to that one site?
* how easy will it be to generalize from the findings?

Thus it will be crucial to identify features for comparison (Bell, 1997).

Cresswell (1998) describes a case study as having the following attributes;

* Focus - developing an in-depth analysis;
* Data collection - from multiple sources e.g. documents, archival records, interviews, observations, etc.;
* Data analysis - descriptions, themes, assertions.

Denscombe (1998) describes the advantages and disadvantages in **Figure 6.9**.

Advantages and disadvantages of case studies as a research tool:

Advantages.

* Allows the researcher to deal with the subtleties and intricacies of complex situations.
* Allows a variety of research methods.
* Links to the validation of data through triangulation.

Disadvantages.

* Often perceived as 'soft' data and lacking rigour.
* Often regarded as alright for providing descriptive accounts of the situation but ill-suited to analysis or evaluation.
* The presence of the researcher can influence what is going on.

Figure 6.9: **Advantages and disadvantages of case studies as a research tool.** (Source: Denscombe, 1998).

Burns (2000) also tells us that case studies can be decried as subjective, biased, impressionistic and lacking in precision. But, in summary, most authors recognise the depth, richness and applicability of the data obtained from such studies.

6.3.3 Focussed interviews.

This research method has been specifically chosen to obtain the views, insights and experience of the 'key players' in the roles of strategists and policy makers, and those responsible for bringing those policies into some form of recognisable format that is of conservation value and which has social and economic benefit. These interviewees represent government agencies, local government, national voluntary sector bodies and individuals from the local voluntary sector. It was intended that the interview format should be neither rigidly formal nor totally unfocussed, but semi-structured or 'focussed' to direct the respondents to key topics and issues but not to limit their imagination.

Robson (2000) promotes focussed interviews as an excellent research method because they have a great degree of flexibility and have the characteristics of a discussion as well as of an interview. This has the advantages of providing potential areas for further investigation, the highlighting of issues that may initially have been hidden, and the potential release of

information from a variety of viewpoints and experience adding depth and richness to the study. As Denscombe (1998) states, the testimony of these 'key players' carries with it a high degree of credibility. The data received lends itself to being used alongside other methods as a way of supplementing their data, adding further detail and depth. Another justification for such interviews is that 'key players' can give privileged information as long as they are willing and able to participate in this way. Caution must also be applied to data received and assessed against the potential for bias.

Denscombe (1998) adds further justification for focussed interviews by stressing the fact that accuracy and relevance of responses can be checked as they are collected. Some interviews may suggest further lines of enquiry or the need to interview other people. However, interviewees respond differently depending on how they perceive the person asking the questions. For instance, the author of this study spent several years as a countryside planner and strategist in a local authority within the River Don catchment. Interviews have taken place with former direct colleagues and with those who were a part of the network of other neighbouring local authority officers known to the author. This has a number of potential outcomes. Either there is no effect, or the respondents feel relaxed and confident and free to open up issues that might otherwise be 'no go' areas, or the respondents may feel intimidated and threatened that they mustn't appear 'stupid' in the presence of a fellow professional. There is therefore a need for the interviewer to remain neutral and non-committal about statements made during interviews. There is also the potential as Bell (1997) says, to 'lead' the respondent. Analysis and evaluation must take account of these potential outcomes.

Also to be addressed in evaluation is the tendency of interviews to produce 'non-standard' responses and that the data produced is unique to that situation or interviewee. This may have an adverse effect on reliability. But the key issue according to Robson (2000) is that the prime concern of the interview is to obtain the interviewee's perceptions within a particular situation or context.

Because focussed interviews have a pre-determined framework, analysis is greatly simplified. Robson (2000) suggests that focussed interviews allow wording of the questions/topic areas to be changed to suit individual respondents, and particular areas that either seem more appropriate can be inserted or if less appropriate can be omitted. This is the case in this study where, although each respondent topic list contains identical areas for discussion there are also additional topics of relevance to individual, or a few, respondents in their areas of operation or responsibility. In formulating these topic lists account was taken of:

* the aims and objectives of the research study;

* the importance (actual or presumed) of the issues to the individual respondents;
* the meanings these aspects have for them;
* the effects of them. (Adapted from Merton, Fiske and Kendall, 1956).

6.4 Strategy for analysis of the data.

Robson (2000) suggests that, compared to tried and tested conventions for the analysis of quantitative data, there is no single set of corresponding conventions for the analysis of qualitative data. Denscombe (1998) proposes that qualitative research tends to be associated with words as the unit of analysis together with a holistic perspective but that there is a need to provide explicit justification of key decisions made. Burns (2000) contends that a preferred strategy for analysing an umbrella case study such as this is to focus on the theoretical propositions that led to the case study. He explains this by saying these propositions will have influenced the design of the research, the literature review, the research questions asked, the sort of evidence investigated and the data assembled. But he also qualifies this by stating that analysis of case study data is the most difficult and least developed aspect of case study methodology. But a vital part of the reflections carried out in the analysis will be an attempt to identify patterns and processes, commonalities and differences (Miles and Huberman, 1994).

Burns (2000) describes the process of developing theories and themes to the collected material as a somewhat intuitive process but not one that is haphazard. It is informed by the purpose of the study, the researcher's knowledge and experience, and the constraints made explicit in what the respondents have said. Miles and Huberman (1994) list the common features of a data analysis process in **Figure 6.10**.

The common features of a data analysis process are:

* adding comments, reflections, etc;
* examining the materials to try to identify similar phrases, patterns, themes, relationships, sequences, differences between sub-groups, etc.;
* elaborating (where possible) a set of generalizations that cover the consistencies gathered from the data;
* linking these generalizations to a formalized body of knowledge in the form of constructs or theories.

Figure 6.10: The common features of a data analysis process. (Source: Miles and Huberman, 1994)

Burns (2000) proposes that, if patterns coincide and there is no fit to a rival alternative, then a case study can claim internal validity. Ongoing comparison with other data may reach a stage where theoretical proposition and explanation fit following testing with rival explanations and propositions. Burns goes on to say that generalizations are difficult to make in case study situations where there will always be an element of uniqueness to each one. He suggests that generalizations should only be made by the reader deciding how similar the case study is to their own situation, and how likely it is to be instructive to it.

Triangulation has already been mentioned as adding richness to the data because it is gained from a variety of sources but it has also helped to identify a level of consistency in the data. Triangulation can be a great aid to proving validity in the research and particularly with regard to proposed theories or perspectives. However, it can also identify discrepancies, contradictions and disagreements amongst the sources. Mason (1996 [b]) describes validity in research as being contingent on the 'end product' and on how that interpretation was reached. In effect this means the creation of an audit trail that justifies the steps taken to reach the interpretation of the data. Burns (2000) suggests that case studies may over-simplify or exaggerate, leading to false conclusions. It is easy to see case studies as holistic and representative when they are really only 'snapshots'. But Robson (2000) says that a common-sense approach is needed when approaching something which is complex and puzzling. The research methods used do not necessarily seek a representative sample for its own sake. But they are purposive and are undertaken so that additional information is available to generate conceptual categories.

Miles and Huberman (1994) list (an adapted version) their tactics for generating meaning from data in **Figure 6.11**. Robson (2000) adds to this as shown in **Figure 6.12**.

Tactics for generating meaning from data:

* noting patterns, themes and trends;
* seeing plausibility in the above;
* searching for clusters of processes or situations with similar patterns/characteristics;
* making metaphors which can be rich, data-reducing and pattern-making devices which help to connect data with theory;
* making contrasts and comparisons between and within the material gathered;
* partitioning variables may help in finding coherent descriptions and explanations;
* linking specific data to general concepts and categories;
* building logical chains of evidence and demonstrating understanding of trends/patterns;
* making conceptual or theoretical coherence by moving from data to constructs to theories through analysis and categorization.

Figure 6.11: Tactics for generating meaning from data. (Source: Miles and Huberman, 1994).

Further tactics for generating meaning from data:

* representativeness - the respondents/material sampled may be unrepresentative;
* the use of triangulation;
* weighting the evidence - some data are stronger than others – typically primary data or from trusted sources;
* checking the meaning of data 'outliers' which don't fit the overall pattern;
* following up surprises that are at variance with your theory of what is going on; this provides an opportunity to possibly revise the theory and to search for evidence to support the revision;
* ruling out spurious relationships - look for unseen third factors or variables which may have caused the apparent relationship;
* checking rival explanations - test potential alternative theories or explanations - logical eradication will strengthen the original concept but it can also avoid premature closure of the research study on false grounds.

Figure 6.12: Further tactics for generating meaning from data. (Source: Robson, 2000).

Burns (2000), Denscombe (1998), Robson (2000) and Miles and Huberman (1994) all stress the need to take account of subjective bias both in the researcher and in respondents. They suggest it is easy to allow equivocal evidence or personal views to influence the direction of the findings and the conclusions. There is also a tendency to take data out of context and not link it to the situation or the 'before' or 'after'. Researchers can allow their own previous experience to influence discussion and follow a tendency to see what they are used to seeing. If any ambiguity is encountered then it can be interpreted according to past experience.

In essence the analysis and evaluation has been responsive to the fact that there are issues of professional accountability, that it may propose change which is not always appreciated and that it may have influence in a political arena. The discussion chapter of the study is likely to be of interest and concern to a wide range of stakeholders and if it concerns change then further work may be needed to discover the barriers to implementation and how these might be overcome. As Robson (2000) suggests, it may be necessary to rephrase the question of change to one of what works best, for whom, and under what circumstances? He also states that successful research can develop from an intuition where it is felt that the work is important, timely and 'right, and that it has 'real world' value in that the issues arise in real situations and lead to tangible and useful ideas.

The following chapters detail the action taken in respect of the stated research methods and discuss the results obtained.

7.0 AN INTERROGATION AND CRITICAL REVIEW OF KEY DOCUMENTATION.

7.1 Introduction.

This desk study of the subject area's key literature is a fundamental component in linking concepts, issues, strategies, policies and wider case studies into the investigation of integrated decision-making in the River Don case study catchment area. In the 'Methodology' chapter this review of the critical documentation of relevance to the study is seen as a key research method to complement data obtained by other methods described later. Denscombe (1998) supports this by stating that documents can take on a central role as part of the actual thing being investigated. Documents can be treated as a source of data, and complementary to other data by deconstructing reference materials to expose the underlying assumptions, concepts and theories that provide support for their claims (Stringer, 1999). Rudestam and Newton (2001) propose different levels of evaluation for different types of documentation. They use the analogy of 'shooting' a film which requires long, medium and close-up shots. The comparison is that long distance shots equate to background information not requiring intensive evaluation, through medium shots requiring summarization rather than critical detail, and on to the close-ups which require careful examination. Such references are critically evaluated so the reader has a clear sense of what is already known about the phenomenon, how reliable and valid are the conclusions based on that work and how the current study will deal with previous limitations and move the field ahead. Of significant importance to this research study Hart (1998) also adds to this by suggesting that a literature review fulfils certain functions as shown in **Figure 7.1**.

Literature reviews can:

* distinguish what has been done from what needs to be done;
* discover important variables relevant to the topic;
* identify relationships between ideas and practice;
* establish the context of the topic or issue;
* rationalize the significance of the problem;
* relate ideas and theory to practice;
* place the research in a historical context.

Figure 7.1: Functions of literature reviews. (Source: Hart, 1998).

This critical review of the key documentation will:

* **provide a clear justification for the chosen topic;**
* **highlight impending issues and trends which may have significant resource implications for relevant agencies;**
* **complement other forms of data to allow richness, depth and breadth in analysis.**

It will focus on the supposition that:

1. ***Wetland management, enhancement and creation (all aspects of restoration and rehabilitation) may present significant opportunities as a platform for regeneration and for balancing former environmental loss and degradation.***

2. ***Wetland restoration projects are critical in facilitating social and economic regeneration at local and regional levels.***

The key areas of investigation have been identified and are shown in **Figure 7.2**.

* **Strategic policies and influences at international, European, national, regional and local levels;**
* **Social issues;**
* **Economic issues.**

Figure 7.2: Key areas of investigation of key strategic documents.

These will now be investigated in some detail.

7.2 Strategic policies and influences.

The catchment of the River Don displays an immense diversity in terms of its semi-natural habitats, land use and settlement patterns. The nature of this complexity is a result of its varying altitude, underlying geology and land use through time. Strategic planning for such areas is thus a complicated issue with constantly changing land use in urban areas, together with changes in agricultural practices in the wider countryside. The number of agencies involved can

also make such planning more complicated although the Don catchment has seen several co-operative strategic ventures between agencies. These will be critically examined later in this study in section 7.2.4.

Tucker and Evans (1997) suggest there is a challenge for governments (at all levels) to move towards the integration of environmental conservation into all policy sectors. In reviewing progress of government action towards this in the UK Avery *et al.*. (2001) report that some significant progress has been made. This has been achieved through the introduction of the Countryside Rights of Way Act (2000) and through the production of Local Biodiversity Action Plans. Evidence for similar action taking place in the Don catchment will also be reviewed in the study. Due to varied reasons, strategic planning has been somewhat haphazard in the past, with agencies and authorities having prescribed boundaries which pay little or no attention to larger scale landscapes, recreational routes and desires, or ecosystem functions. This means that policy formulation and land use requirements for adjacent areas could be quite different. Noss and Harris (1986) suggest that every landscape has 'nodes' of unusually high conservation value and these should receive high priority for protection. But they also state that for these to function in perpetuity, then the sites must be buffered, interconnected by corridors, and permitted to interact with surrounding natural/semi-natural habitats. This will be important for future identification of suitable areas for nature conservation development in the Don catchment. There should also be an integration of conservation and development planning for long-term maintenance of environmental quality. This must exist across notional political and departmental boundaries. This is perhaps one of the first references to the need for integrated river basin management.

Figure 7.3 overleaf shows the hierarchy of a selection of current policies affecting the catchment of the River Don.

INTERNATIONAL INFLUENCES

e.g. United Nations Conference on Environment and Development; Ramsar Convention.

EUROPEAN UNION INFLUENCES

European Union Habitats and Species Directive, Common Agricultural Policy, Special Areas of Conservation and Water Framework Directive; WWF Living Rivers Initiative.

NATIONAL INFLUENCES

e.g. Urban White Paper; Rural White Paper; Planning Policy Guidance; UK Biodiversity Action Plan; Environment Agency Policies; English Nature Policies; Countryside Agency Policies; Regional Water Resources Strategies.

REGIONAL STRATEGIES

e.g. Countryside Agency's Countryside Character Areas; English Nature's Natural Areas.

SUB-REGIONAL STRATEGIES

e.g. Local Environment Agency Plan – Don, Dearne & Rother catchment; Don/Dearne Green Corridors Strategy; Upper Don Tributaries Study; South Yorkshire Forest Plan; Humberhead Levels - a Land Management Initiative of the Countryside Agency; River Rother Wildlife Strategy.

LOCAL STRATEGIES

Sheffield MDC

e.g. Unitary Development Plan; Nature Conservation Strategy; Biodiversity Action Plan; Countryside Management Strategy; Access to the Countryside Strategy; Woodlands Policy; Five Weirs Walk; Upper Don Walk Feasibility Study.

Rotherham MBC

e.g. Unitary Development Plan; Countryside Study; Biodiversity Action Plan; Countryside Management Strategy.

Barnsley MBC

e.g. Unitary Development Plan; Biodiversity Action Plan.

Doncaster MBC

e.g. Unitary Development Plan; Biodiversity Action Plan.

Derbyshire County Council

e.g. County Structure Plan; Biodiversity Action Plan.

North-East Derbyshire District Council

e.g. Local Plans

Figure 7.3: Hierarchy of current, documented strategies/policies affecting the River Don catchment.

There has been some attempt to 'regionalise' policy formulation but even those such as the *Upper Don Tributaries Study*, the *South Yorkshire Forest Plan* and the *Don/Dearne Green Corridors Strategy* are limited by the geographical boundaries of responsibility of their lead agencies. Perhaps the only completely regional focus comes from the *Local Environment Agency Plan* (LEAP) for the Don, Dearne and Rother catchment. These will be examined in more detail later in the study in section 7.2.4.

The following sections provide a stage by stage examination of aspects of the various policy influences detailed in **Figure 7.3**. These show a potential set of clear strategic pathways that should enable rational criteria for site selection of projects. But the question will later be asked as to whether this is the reality of what happens in practice or whether project development is more dependent on opportunities that arise.

7.2.1 International influences.

Although planning at local and regional levels has perhaps the greatest influence on the landscape of the catchment, these policies in themselves have been influenced by more global discussion. One such influence has been the 1992 United Nation Conference on Environment and Development at Rio de Janeiro, Brazil. Through its Convention on Biological Diversity it requires each contracting party to develop national strategies for the conservation and sustainable use of biological diversity (UNCED, 1992). The conference also defines sustainable development as a development that meets the needs of the present without compromising the ability of future generations to meet their own needs (UNCED, 1992). The Aalborg Charter (Denmark, 1994), gives a clear message that economic development, social welfare and protection of the environment cannot be achieved separately from each other (Payne and Loffler, 1999; Box, 1986). Box develops this by stating that environmental degradation can be caused by misguided economic policy and that environmental improvements can be brought about by changes in economic policy.

Denny (1994) suggests that this integration of factors relating to the sustainable use of the environment is directly pertinent to the conservation of wetland diversity and if wetland conservation is to be effective there has to be an overall national strategy in which local people, local and national governments, and the international community, can be associated. The basis for the establishment of the Ramsar Convention, 1971, has been recognition of the rapid and continuing world-wide loss and degradation of wetlands (Moser *et al.*., 1996; Moser, 2000). 'Wise use' was defined by the Convention on Wetlands of International Importance especially as Wildfowl Habitat (The Ramsar Convention, 1987) as follows,

"... their sustainable utilisation for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem."

In **Figure 7.4** Salathe (2000), European Coordinator of the Ramsar Convention, and Lethier (1993) have outlined the 'wise use' guidelines.

Important factors of the 'wise use' guidelines:

* Integrated river basin management approaches;
* The need to strengthen institutional capacities;
* Involving stakeholders;
* Community participation and public awareness;
* Assessing and enhancing the role of wetlands in water management;
* Minimising the impact of land use/development projects on wetlands and their biodiversity;
* Maintaining natural water regimes to maintain wetlands;
* International co-operation for shared river basins and wetland systems.

Figure 7.4: Important factors in the guidelines for 'wise use'.

Rubec (1993) and Mafabi and Taylor (1993) in reporting on the development of national wetland policies in Canada and Uganda respectively, both highlight the importance of the process in providing a framework for long-term co-operation between diverse authorities with influence over and/or responsibilities for wetland resources. An outcome of five years of case study application of 'wise use' principles is that there is no fixed recipe for wetland management but that the critical requirement for effective wetland management is the development of an appropriate conservation ethic rather than acceptance of a detailed, 'hands on' management methodology (Davis, 1993).

In **Figure 7.5** Davis (1993) also suggests that such case studies have indicated strong guiding principles.

Guiding principles for 'wise use':

* Social and economic forces are the main reasons for wetland loss and therefore need to be of central concern in 'wise use' programmes;
* Special attention needs to be given to local populations who will be the first to benefit from improved management;
* 'Wise use' programmes should seek to involve and, where appropriate, work through partnerships of public and private institutions having relevant expertise;
* Specific site projects may often demonstrate the need for more general institutional requirements for the 'wise use' of wetlands;
* Wetlands form an integral part of a wider catchment and 'wise use' projects must take into account the problems and issues affecting this wider area;
* While comprehensive understanding of the ecological constraints of a wetland system should be sought, when such knowledge is unavailable, activities affecting wetlands should be governed by the 'precautionary principle'.

Figure 7.5: 'Wise use' case study principles.

Although this discussion was about wetland sites of international importance its principles suggest application at a much more local level and should be considered in any proposals for the Don catchment. The Environment Agency (Online, undated [a]) stipulate that 'wise use' of wetlands should aim to conserve the natural resources of a wetland whilst allowing limited exploitation that does not irreversibly destroy the wetland's functions or its ability to support people and wildlife based on an understanding of mutual dependency between landowners, farmers and conservation interests. In an area such as the Don catchment, which has large areas of settlement and industry, then the mutual dependency becomes increasingly important yet far more complicated. This complexity will be reflected in such things as deciding the boundaries of damage, deciding the boundaries of responsibility, competition for resources, the effects of specific methods of exploitation and the priorities of community needs (in their widest sense).

Everard (1997) describes a long history of continuing over-exploitation of British wetlands and suggests that there is a significant body of obligations for their protection and 'wise use'. It is suggested that to provide adequate protection it is essential that the wide-ranging socio-economic and ecological benefits that wetlands provide are accounted for in decision-making on all relevant development and land management issues.

These international conventions are clearly meant to influence national governments in their policy formulation, but the key issue for individual catchments like the River Don is that this policy formulation is crucial to raise awareness which will, in turn, prioritise allocation of resources and stimulate local action.

7.2.2 Influences of the European Union.

7.2.2.1 The EC Habitats and Species Directive (1992).

This Directive was a major step forward in carrying out the commitment made by signatory nations to protect their own country's wildlife and wildlife habitats. The Directive builds on work already completed under the Birds Directive (1979) with site protection being provided through the Natura 2000 initiative. This has developed into a requirement on Member States to designate Special Protection Areas (SPAs) several of which are in freshwater habitats. UK wetland SPAs mostly are also Ramsar designated sites of international importance especially for waterfowl. Special Areas of Conservation (SAC) which, in the UK, are selected from areas which are already protected nationally as Sites of Special Scientific Interest, were designated by the UK Government under the European Directive on the Conservation of Natural Habitats and Wild Fauna and Flora, 1992. Although the Directive targets the most important sites, its value to local sites is that, through its implementation, it creates a culture of conservation within the political arena. Thorne and Hatfield Moors in the Humberhead Levels (part of which falls within the Don catchment) has recently been designated as a SAC. Recent news is that there will be a ban on mining of peat in these areas by 2005.

7.2.2.2 The Common Agricultural Policy.

Agricultural policy across Europe, but particularly in the UK because of its island nature, has been largely based on subsidies to provide self-sufficiency following the food shortages of World War II. Barter (online, 2002) states that almost half the European Union's (EU) budget (approximating to 40 billion euros per year) is allocated to agricultural subsidies through the Common Agricultural Policy (CAP). In the past this high level of price support and unlimited and guaranteed outlets has favoured technological progress for intensive agriculture which has increasingly used more fertilisers, herbicides and pesticides, and has contributed to the controversial 'lakes' and 'mountains' of agricultural surpluses. Price support has resulted in soil and water pollution destroying important ecosystems and requiring expensive treatment systems. It has also resulted in the destruction of significant landscape features and in drainage of wetlands, contributing to the loss of habitat (Anon., online, undated [c]). These aspects are

very evident in the low lying flood plain of the Don to the east of Doncaster and of particular relevance to this study has been the rapidly increasing rate of drainage of wetlands and abstraction of water for irrigation (thus reducing river flows and levels).

Latterly, reforms are being proposed within the European Union to comply more closely with consumer concerns over agricultural effects on the environment and with food standards. The Rio Summit placed requirements on signatory member States to integrate environmental concerns into all policies (UNCED, 1992). Over the following two decades since Rio consideration has been given to the integration of policies within the CAP for the prevention of pollution, the minimisation of environmentally harmful farming practices, and for the preservation of natural heritage.

The Countryside Agency (2000) with the Countryside Council for Wales, English Nature and Scottish Natural Heritage have together sought to influence the debate on CAP reform in order to reduce environmental damage and secure more benefits for the environment and the rural economy. They have suggested a model of land-based, rural support and suggest there is a rural conservation tradition combining land-use regulations, incentives and prohibitions; an agricultural policy tradition of market mechanisms and incentives and a pollution control tradition of preventative advice backed up by regulations. Existing policy measures and tools are shown in **Figure 7.6**.

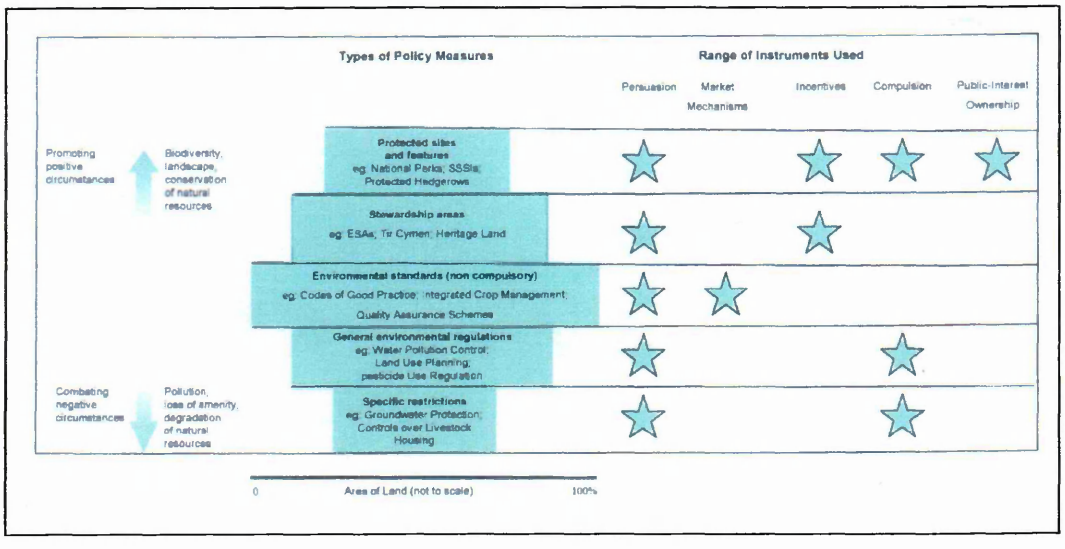


Figure 7.6: **Existing policy measures and tools of the CAP.** (Source: Countryside Agency, 2000).

In a document reviewing the challenge of integrating environmental requirements into the CAP the European Commission have categorically stated that the need to take account of environmental concerns is not only a legal requirement but is vital for the very existence of the

policy, but it must be market-oriented, environmentally friendly and multi-functional, thus responding to all the demands society places upon it (Anon., online, undated [c]).

At the Berlin Summit in March 1999, EU Heads of State or Government concluded negotiations on Agenda 2000 for CAP reform. Of significance to this study is a recognition that farming practices must change to meet new concerns and priorities. Farmers are involved in the management of nearly half the Community's land area and thus sustainable agricultural practice is critical in minimising the impact of economic activity on the environment. A large proportion of the Don catchment is under agricultural production of one form or another. Agenda 2000 categorically states that the policy framework within which farmers work must balance the needs of efficient farming with environmental safeguards and improvements (Anon., 2000a). A previous reform of the CAP in 1992 had introduced support measures for agri-environment measures at European level to encourage more environmentally-friendly production measures. In the UK these measures take the form of such grant-aid schemes as Countryside Stewardship.

Agenda 2000, the most recently proposed reform of the CAP, has a rural development policy which includes the strengthening of agri-environment measures. These provide payments for commitments going beyond good agricultural practice. Such financial support is the only way to ensure that farmers do not either abandon unproductive land or manage it in an unsustainable way. In this way habitats and landscape features will be preserved and, just as importantly, managed as dynamic systems. This could be of great significance in the Don catchment.

7.2.2.3 The EU Water Framework Directive (2000).

Adopted by the European Parliament in December, 2000 this Directive is, perhaps, the most critical piece of legislation of the period, and should be a major milestone in safeguarding the provision of water both for the environment and for people. It is likely to create major issues for local authorities and other agencies in the Don catchment. These will involve cultural changes in the way these agencies react to each other, as it is suggested that there has been a history of independent working, of secrecy and of competition for resources. The Directive has regulatory powers to ensure compliance but at the same time provides a focus for allocation of resources on a more sensible priority basis and for projects that may well cross administrative boundaries. It will also provide more effective conservation protection and development opportunities and

will integrate social, environmental and economic issues in a much more effective way than other, more piecemeal, approaches have in the past.

The Directive focuses on establishing the right conditions to encourage efficient and effective water protection at the local level. It sets new ecological standards for rivers, lakes and estuaries, requiring management of the water cycle with and for nature, rather than past and current trends in spite of it. The Directive embraces flood defence, drinking water quality and wildlife habitats as part of the same package and should replace the current system of planning (Norris, 2002). The specific benefits desired to be effected by the Directive are shown in **Figure 7.7**.

Benefits of the Directive:

* improved ecological quality of European freshwater and coastal ecosystems;
* biodiversity gains (better management of aquatic and wetland habitats/species);
* improved sustainable water use (more efficient water resource use management);
* reduction of water pollution;
* mitigation of the effects of floods and drought;
* improved efficiency and effectiveness of water policy, with better targeting and reduced costs. (Anon., 2001a).

Figure 7.7: Benefits of the Water Framework Directive.

Previous European water legislation set objectives to protect particular uses of the water environment from the effects of pollution and to protect the water environment itself from especially dangerous chemical substances. As well as incorporating these the Directive introduces new, broader ecological objectives, designed to protect and restore the structure and function of aquatic ecosystems, thus safeguarding the sustainable use of water resources (Anon., 2002b). The overall aim of the Directive is to protect all surface waters and groundwater through a framework using the river basin as the management unit. The specific environmental objectives include the requirement to produce River Basin Management Plans, preventing the deterioration of ecological quality and restoring polluted surface and groundwater in order to achieve 'good status' by 2015 at the latest (WWF, online, updated Sept 2000). The Environment Agency are currently defining river basin districts for England and Wales and it would appear that the Don catchment will be part of a district that links the north and south sides of the Humber Estuary. The definition of 'good status' is shown in **Figure 7.8**.

'Good status' is defined by the Directive as a measure of how much, or how little, the status of a body of water deviates from 'undisturbed' conditions. Water quality itself is a necessary, but not sufficient, requirement to achieve 'good status'. For example, good quality water in a highly engineered channel would not achieve 'good status'. The Directive has therefore added 'good ecological status' as a requirement for surface water bodies. This measures species variety and abundance, flow, temperature, dissolved oxygen, etc.
(Anon., 2001 [a]).

Figure 7.8: Definition of 'good status' as required in the Water Framework Directive.

The Directive does not set environmental objectives for wetlands in the same manner as it does for rivers, lakes, estuaries, coastal waters and groundwater. But it will contribute to the protection, restoration and re-creation of wetlands as shown in **Figure 7.9**.

Protection and restoration of wetlands through the WFD:

1. The effects of groundwater pollution, or over-abstraction on terrestrial ecosystems that depend on groundwater, such as wetlands, must be controlled to achieve groundwater 'good status'. To do this it will be necessary to develop and understanding of the water needs of these terrestrial ecosystems, and to establish criteria for defining what constitutes significant damage to them.
2. The ecological quality of surface waters depends to some extent on the structure and condition of the land immediately surrounding them. Wetlands immediately adjacent to rivers and lakes must be protected and restored in so far as is necessary to achieve the ecological and chemical status objectives for those waters.
3. Wetlands can provide an effective means of trapping and breaking down pollutants that would otherwise leach into surface waters. Thus wetland re-creation may be an important and cost-effective means of controlling urban and agricultural diffuse pollution. (Anon., 2002b).

Figure 7.9: Protection and restoration of wetlands through the Water Framework Directive.

The timetable of deadlines for implementation of the Water Framework Directive across Member States is a 15 year implementation period which commenced in 2000. This phased process is shown in more detail in **Appendix 2.**

According to Norris (2002) the Directive is the most important water-based environmental legislation ever produced. She comments that, although it is complex and technical, its instruction is simple in that it aims to prevent deterioration, and restore the health, of wetlands and waterways. The challenge to governments of member states (and the agencies that will implement it in areas such as the Don catchment) is to grasp this extraordinary opportunity.

A series of working seminars has been organised by WWF with the support of the European Commission, to promote the effective implementation of the Water Framework Directive. The first seminar entitled *'Water and Agriculture'* took place in February 2000, the second entitled *'The Role of Wetlands in River Basin Management'* in November 2000, and the third and final session entitled *'Good Practice in River Basin Planning'* took place in May 2001.

In summary, the outcomes of the three seminars administered through the European Freshwater Programme of the Worldwide Fund for Nature (Anon., 2000 [d]) are shown in **Figure 7.10**. More detail from these seminars is shown in **Appendix 2**.

Opportunities provided through the WFD:

* obliges Member States to 'restore all surface waters' and hence 'flood plains' with the aim of achieving the environmental objective of 'good status'.
* promotes integrated river basin management (as a means of achieving 'good status' of ground and surface waters), which may act as a catalyst for restoring flood plain wetlands in view of their role in nutrient reduction and sediment trapping.
* 'recreation and restoration of wetlands' is one of the supplementary measures for achieving 'good status'.

Figure 7.10: Opportunities provided by the Water Framework Directive.

However, they also list a number of obstacles as shown in **Figure 7.11** overleaf.

Obstacles:

* Being a Framework Directive the WFD is not accompanied by a corresponding financial instrument. However, existing Community funding could be used to co-finance some of the measures required to achieve 'good status', but the precise measures to be taken will be defined by individual Member States. This reliance on the initiative of Member States may mean that the opportunities for restoration – as a means of meeting the WFD's environmental objectives – are not taken up.
* There are no formal guidelines attached to the WFD on how stakeholders from different sectors can be effectively integrated into the river basin management planning and decision-making process.
* Member States have a poor record of implementation of existing Community legislation on Water. (This contention is supported in a UK situation in the Fourth Report of the House of Commons Select Committee for Environment, Food and Rural Affairs relating to the implementation of the WFD in England [Anon., 2003]).
* The timetable for the implementation of the WFD is long.
* Flood plain restoration will not be helped by some waters being exempted from the need to achieve 'good status' (derogations for 'artificial and heavily modified waters' and for waters undergoing new modifications to the physical characteristic). Thus some of the most significant benefits for 'water status' could be attained in what could already be considered as 'heavily modified' flood plains (e.g. Danube and Rhine).

Figure 7.11: Obstacles embodied in the Water Framework Directive.

Madgewick (2000) suggests that, despite many positive indications, there are still major obstacles to achieving flood plain protection and restoration that stem partly from inconsistencies in EU policy and economic instruments. Obstacles are also partly created by national policies and local issues such as stakeholder conflicts and complex administrative and land tenure systems. She suggests a need for further, radical reform of EU agricultural and regional policies in order to dampen the driving forces behind flood plain loss and degradation.

Other authors have recognised the need for integrated planning. For instance, Hutchings (1999) suggests that integrated river basin management plans have been in existence in England and Wales for several years in the form of *Catchment Management Plans*. More recently, the Environment Agency embarked on a programme of *Local Environment Agency Plans* (LEAPs)

covering all catchments in England and Wales by the end of 1999. However, personal contacts within the Agency suggest that these now need replacing. Hutchings also states that integrated river basin management involves taking account of the inter-dependency of natural and human factors within a catchment. Decisions on what to do in one part of a catchment are informed by knowledge of the consequences for the rest of the system. The system includes not only scientific and technical assessments but also consideration of socio-economic issues.

The Environment Agency in England and Wales already divides rivers and estuaries into stretches to help target the management of point source discharges of pollutants, and water resources are managed through the Catchment Abstraction Management Strategy framework (CAMS) using water resources management units. Within the implementation of the Water Framework Directive in these countries these types of approaches will need to be further developed and extended to groundwaters (Anon., 2002b).

7.2.2.4 Worldwide Fund for Nature's (WWF) European initiatives.

WWF are committed to systematically investigating the efforts that Europe's governments are undertaking in the management and restoration of freshwater ecosystems and water resources. The results have been summarised as a '*Water and Wetlands Index*' which will be used to influence decision-makers and to promote action at national and international levels (Anon., 2001 [b]). The objectives of the Index are shown in **Figure 7.12**.

Objectives of the Index:

* to establish a 'benchmark' for water and wetland policy and management practices in Europe;
* to build capacity for freshwater management by serving as a basis for discussion of the needs for management changes within wetlands, lakes, rivers and groundwater;
* to improve awareness among the general public about the status of freshwater ecosystems and the efficiency and sustainability of water use;
* by highlighting good practice, to accelerate the process of implementing 'sustainable development', 'wise use' of water and wetlands, and 'good' agricultural practice.

(Anon., 2001 [b]).

Figure 7.12: Objectives of the Worldwide Fund for Nature's '*Water and Wetlands Index*'.

Another important political step in highlighting issues affecting rivers has been the WWFs *'Living Rivers'* initiative. This presents rivers and associated wetlands as integrated living systems that are essential components of river basins. The initiative describes them as being the most vulnerable and endangered ecosystems in Europe as a direct result of human influence. The WWF initiative is a direct call for restoration of river systems that have been extensively altered, suggesting that, if protected and used wisely, there will considerable benefits for people and wildlife. They claim that ecologically-based river management has been proven to work and it makes economic sense through offering better flood control and regulation, productive natural resources, natural purification and a richer diversity of wildlife (WWF, online, undated). This adds to the pressure on the 'trickle' system of policy formulation to local levels for potential regeneration projects such as in the Don catchment to include wetland restoration, rehabilitation, enhancement and creation as economic and social prerequisites.

Mason (1996 [a]) supports this view reflecting that resource use and effluent disposal are better integrated because they are considered in relation to regional needs. Tucker and Evans (1997) affirm this by suggesting that inland wetlands concentrate demand and the potential for conflicts in use, and advocate a requirement for integration of activities within the catchment as a complete unit. They, and Rose *et al.* (1998) argue that even when sites are protected and managed for conservation, they are not independent of the wider environment and may be influenced by external factors such as upstream alterations to river drainage basins. It should not be forgotten that sites, habitats and species not currently considered under threat could soon become so.

Integrated management is also promoted through the Ramsar Convention but one of the potential problem areas is the division of management responsibilities for one river basin between different administrative authorities, resulting in fragmented approaches to water resources planning and management. It is likely that this will be a critical issue in the Don catchment. It is also stressed that water resource planning and management is a multi-disciplinary process to be promoted as a collaboration among all relevant agencies operating nationally, regionally and locally, including the local communities affected (Anon., online, undated [d]). Salathe (1993) suggests that such management is the synchronisation of diverse and opposing interests towards a common goal of conservation and sustainable utilization, even if it is a difficult and time-consuming exercise.

7.2.3 National influences.

Traditionally, the focus of nature conservation effort in the UK has been directed towards sites of renowned wildlife or earth science significance (Ratcliffe, 1977; Anon., 1994a). This has occurred through the statutory designation of National Nature Reserves (NNR) and Sites of Special Scientific Interest (SSSI) embodied in the Wildlife and Countryside Act, 1981 (with later amendments). Whilst in the main this system has been a success, there has nevertheless been recognition that it is not sufficient to prevent the continuing deterioration of the total wildlife resource in the country (Anon., 1993a). More recently there have been moves to give greater protection and resources to what could be termed 'second-tier sites' which are of obvious conservation interest but which do not meet the rigid criteria of SSSI designation (Lunn, 2000).

In June 1992 the UK was one of 157 countries which signed the Convention on Biological Diversity. This required the development of national plans or programmes for the conservation and sustainable use of biological diversity. In 1994 the UK Government published 'Biodiversity: The UK Action Plan' and set up the UK Biodiversity Steering Group with a broad, cross-sectoral membership. The Steering Group's report, endorsed by Government in 1996, contains costed action plans for 14 key habitats and 116 species of plants and animals (49 of which are dependent on freshwater habitats). A number of regional and local biodiversity initiatives are also being undertaken. The action plans set conservation targets and timetables for action (English Nature, 1997).

Everett (2000 [a]) reports that the Countryside and Rights of Way Bill recommended that English Nature be given the power to negotiate management agreements with landowners in the wider countryside, outside Sites of Special Scientific Interest, to cover features of importance to biodiversity.

Since 1989 the management of the water cycle in England and Wales has devolved into separate functions. The provision of water and the treatment of sewage became the responsibility of newly-privatised water companies, but the task of monitoring river quality and setting standards was undertaken by the National Rivers Authority (NRA) under the direction of central government through the Department of the Environment. In the mid 1990s the roles and responsibilities of the NRA were subsumed within the wider ranging remit of the Environment Agency. This remit includes being responsible for maintaining a sustainable balance between human demands for water and those of the natural environment (Hutchings, 1999). Water pollution control is a main function of the Agency.

The European Union's Water Framework Directive includes ecological quality requirements for water. These include fixed standards for a wide range of physical, chemical and microbiological determinands that must not be exceeded. Although the cost of meeting these standards is likely to be considerable, a principle of 'the polluter pays' is being mooted and that they, the polluter, should contribute to the cost of monitoring, regulating and controlling the adverse effects of that pollution (Mason, 1996).

The National Rivers Authority also introduced the concept of catchment management that involves a multifunctional and multi-use appraisal of the catchment and results in an agreed strategy for achieving its environmental potential within prevailing economic and political constraints (Hutchings, 1999). These plans were later adopted by the Environment Agency who have stated that,

"A basis for good management is effective planning of the environment, which entails having an understanding of the complex and dynamic processes that are at work in the water environment, carefully assessing the state of the environment, the management options available and the projected effects that each will have". (Environment Agency, online, undated [d]).

Martindale (2000) reports on a study on the sustainable use of fresh water resources with reference to regional catchment management. He stresses the need for cross-political boundaries to ensure that harmonisation of water policy, development policy, agricultural policy and conservation measures is carried out with a holistic approach and not in isolation. He suggests that regionalisation of bodies to manage catchment areas irrespective of political boundaries is required.

There is also the danger of 'design by committee' which usually produces something that hasn't really changed or which is unworkable in practice. All projects need a 'champion' - someone who is passionate about it and who will fight for it but who will be tempered by other viewpoints. Sutherland (2000) supports this by proposing that conservation strategies and priorities depend upon key individuals using rational decision-making techniques rather than arbitrary ones. This will become evident in research of the case study sites in the Don catchment. He also suggests an imperative need for transparent principles and data in such decision-making, as then it will be much easier to participate in strategic, political and economic debate. Setting priorities usually requires value judgements and recognition of political and resource realities.

In 1994 the Ministry of Agriculture, Fisheries and Food (MAFF) in collaboration with the Welsh Office, the Association of Drainage Authorities, English Nature and the National Rivers Authority, produced a guide to the creation of Water Level Management Plans to assist operating authorities responsible for flood defence and land drainage (Swash, 1998). The guide is targeted specifically as a procedure for the production of a plan for sites of conservation interest where water levels can be controlled, and particularly giving priority to sites that have at least a Site of Special Scientific Interest notification (Anon., 1994b). Most of these sites are in low-lying areas where there has been much change to the landscape and its ecosystems through drainage for agriculture and development, changes in agricultural practices or embankments for flood control. Many were once contained in vast areas of bog and fen and, in addition to the richness and diversity of their flora and fauna, often contain some of the most important and best-preserved archaeological remains (Van der Noort and Ellis, 1997). Thus, sensitive water level and land management are crucial if the conservation interest is to be maintained, enhanced or restored.

But such management, although praiseworthy in its approach, is fraught with potential conflicts. Agricultural land created from the draining of lowland, flood plain wetlands is some of the most fertile and highly productive in the country. Waterlogging can be detrimental to soil structure (for agricultural purposes) and may lead to reduced yields. Peat-based soils require hydration to prevent shrinkage (Anon., 1994b).

Yet wetland wildlife is dependent on differing degrees of wetness, possibly to varying degrees at different times of the year. An example of a water management regime primarily targeted at wildlife could be to flood grassland in winter for over-wintering wildfowl and waders, but once the flood waters subside it is necessary to maintain damp conditions into spring and early summer for breeding waders (Anon., 1994b). This leaves little accommodation for productive agriculture.

Such conflicting uses mean that decisions on water levels may not be easy to achieve and delicate negotiation must be employed, possibly alongside financial incentives. An example of the passions that can be brought forward could be seen in the long-running debate on land management in the Somerset Levels in the 1980s which, at its most animated point, saw effigies of English Nature and RSPB officers hanging from a gibbet.

The Habitat Scheme was introduced by MAFF in 1994 and has three options, one of which is Water Fringe areas. The scheme allows farmers in designated areas to utilise sympathetic management of riverside fields; to create watercourse buffer strips; and to reduce bankside

erosion. (Swash, 1998). At present the Scheme is only in its pilot phase but the government has suggested that it will be integrated with the Countryside Stewardship scheme. This could make the Scheme available to more catchment areas.

DEFRA has lead responsibility for the implementation of environmental objectives of the European Union. In 2002 the department issued its vision for what they think should be the priorities for government policy on water in England in its consultative document *'Directing the Flow – Priorities for Future Water Policy'*. The document is essentially a response to the implications of the Water Framework Directive (WFD) and lists a number of key commitments (see **Figure 7.13**) alongside implementation of the WFD.

The key commitments by the British government to the Water Framework Directive are to:

* identify further measures needed to address diffuse pollution from agriculture;
* examine the scale of the problem of urban diffuse pollution and the options for addressing it;
* ensure land use planning guidance takes proper account of water objectives;
* consider the needs for additional water quality objectives to protect our more important biodiversity sites;
* make systematic moves to achieve integration between different river basin management plans, including flood management plans;
* extend, in 2003, the Green Technology Challenge to include increased capital allowances to encourage water efficiency and improve environmental water quality;
* take new enabling powers in the forthcoming Water Bill for new and more broadly-based water company performance targets to be set where needed, in order to improve efficiency of supply and further reduce leakage.

Figure 7.13: UK governmental commitments to the WFD. (Source: Anon., 2002d)

7.2.4 Regional, sub-regional and local influences.

As indicated in the hierarchy of influences shown in **Figure 7.3**, there are several strategic issues which are reflected in approaches to the area that contains the catchment. Because nature conservation has taken on a broader remit in the last two decades, strategic policies at the regional level have also been developed to take account of this. In England, for example, the concept of *Natural Areas* and *Countryside Character Areas* are being promoted by English

Nature, the Countryside Agency and English Heritage to develop conservation objectives and programmes across whole, identified landscapes and not just special sites. Such planning will involve integrated management of all the social, economic and environmental component features of such landscapes (Anon., 1993b). However, two themes which could be neglected in this planning process, and which have traditionally been so in nature conservation projects, are the intrinsic value of urban, anthropogenic and post-industrial environments (Box, 1993).

7.2.4.1 Upper Don Tributaries Study.

At the sub-regional level there are some important strategies relevant to the examination of existing and potential wetlands in the Don river basin. One such strategic document relating to part of the catchment is the ***Upper Don Tributaries Study*** (Anon.,1989), covering 94 square miles of South Yorkshire lying within or adjacent to the Peak District National Park. The report was produced by a co-operative group of authorities consisting of the Peak Park Joint Planning Board, Barnsley Metropolitan Borough Council, Sheffield Metropolitan District Council and Yorkshire Water Services PLC. The area of study covers the higher parts of the catchment with gritstone moorland which flow to the River Don. Many of these streams have been impounded to form reservoirs supplying water to urban areas further east. There are extensive plantations within the reservoir catchment areas and some rough and improved pasture. Much of this study area is extremely popular for informal recreation and for its aesthetic attraction. The purpose of the *Study* is to consolidate and extend existing policies and proposals for recreation, conservation, land and water management in the area. The draft policies and proposals represent a statement of intent and a commitment to pursue implementation through joint working. The document proposes management policies which the parent authorities have agreed should guide decision-making. **Figure 7.14** shows the main objectives of the Study.

The main objectives of the *Study* (which is non-statutory) are:

* to conserve the high landscape quality, ecological and historical value of the study area.
* to maintain and improve recreational opportunities appropriate to the study area unless they conflict with the previous objective.
* to ensure that any new facilities which may be provided are accessible to major visitor catchment areas and relieve recreational pressure on the more sensitive parts of the study area.

Figure 7.14: Main objectives of the Upper Don Tributaries Study. (Source: Anon., 1989).

Also relevant is the ***South Yorkshire Forest Plan*** which covers a large area of the catchment around the urban centres of Sheffield, Rotherham and Barnsley. It aims to form a key element in assisting the economic regeneration of South Yorkshire (Anon., online, undated [e]). The *South Yorkshire Forest* concept is supported by Barnsley MBC, Sheffield MDC, Rotherham MBC, the Countryside Agency and the Forestry Commission. The designated *Forest* area is a mix of open spaces, woodland, wetlands, farmland and urban areas, industry and housing covering 153 square miles. Its boundaries are shown in **Figure 7.15**.

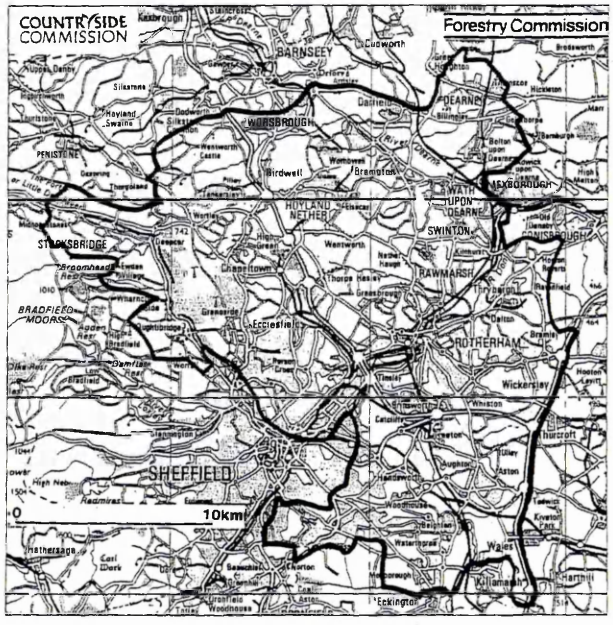
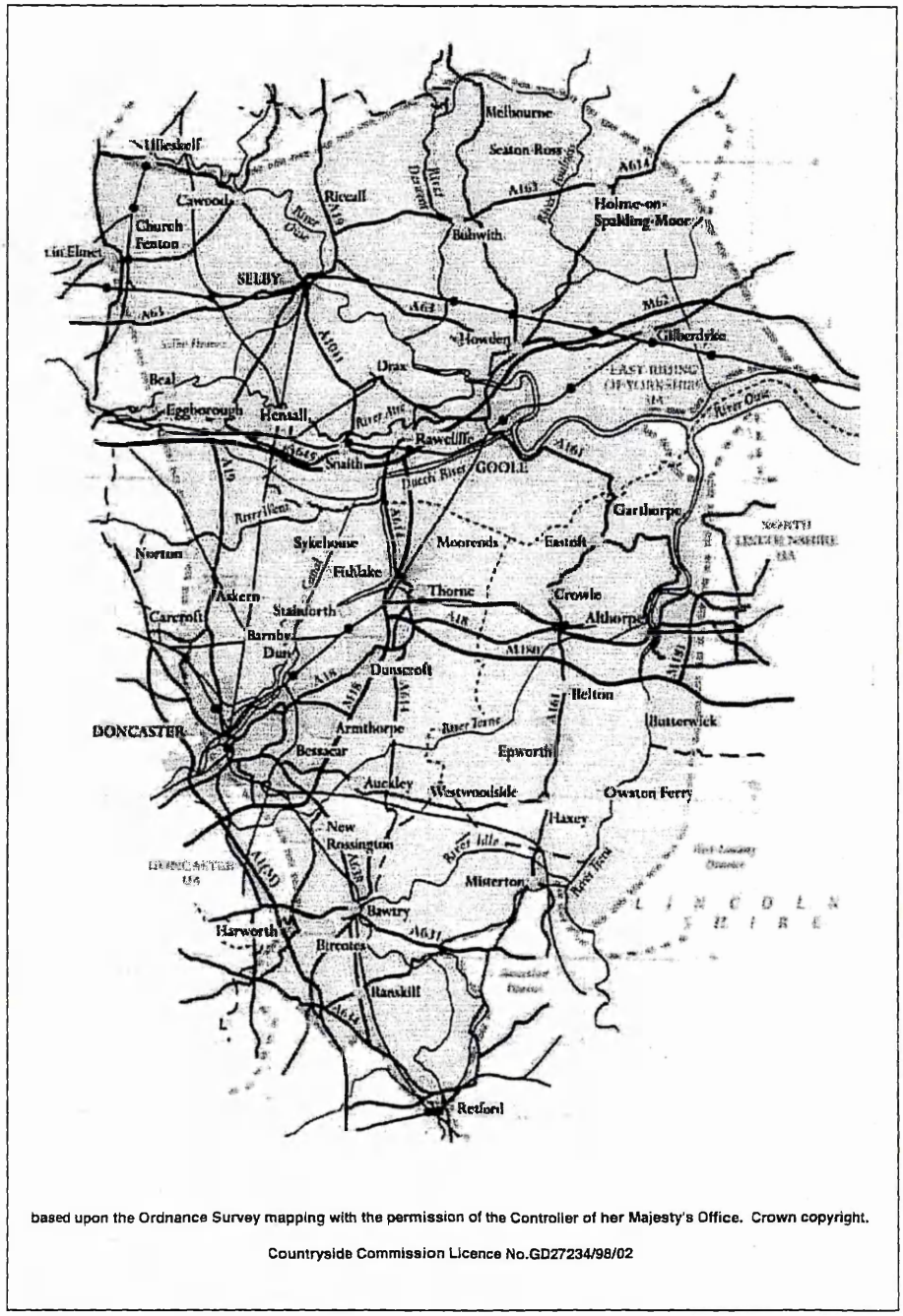


Figure 7.15: Boundary of the South Yorkshire Forest.

The non-statutory *Forest Plan* (2000) states that it will put in place an integrated vision for transforming the environment, creating access to a countryside experience on people's doorstep, and improving the quality of life for local people who have least access to more traditional rural areas. Involving people in the process of developing these places provides new direct opportunities for economic enhancement, jobs and training. An improved environment also leads to a healthier environment (Anon., 2000f).

The ***Humberhead Levels Flood Plain Land Management Initiative***, known as ***'Value in Wetness'***, has a strong focus on issues relating to agricultural production in wetland areas. Its area of interest is shown in **Figure 7.16** and it can be seen that part of the Don catchment lies within it.



based upon the Ordnance Survey mapping with the permission of the Controller of her Majesty's Office. Crown copyright.

Countryside Commission Licence No.GD27234/98/02

Figure 7.16: **Area of interest of the Humberhead levels Flood Plain Land Management Initiative.** (Source: Countryside Agency)

The original course of the River Don would have been influential to these important wetlands, particularly Thorne and Hatfield Moors (outlined below), but drainage schemes have diverted the river away from its former confluence with the River Trent into the River Ouse further west and north.

The Levels consists of a large, open and flat flood plain lying at the head of the Humber Estuary between South Yorkshire, East Yorkshire and North Lincolnshire. It represents the area originally occupied by the post-glacial Lake Humber. Waterlogged conditions have given rise to widespread peat deposits that have survived in the current landscape of the raised mires of Thorne and Hatfield Moors, which are the largest continuous extent of remnant raised mire in England. A schematic map of these areas to the north east of Doncaster is shown in **Figure 7.17** and a photograph of representative habitat on the site is shown in **Figure 7.18**.

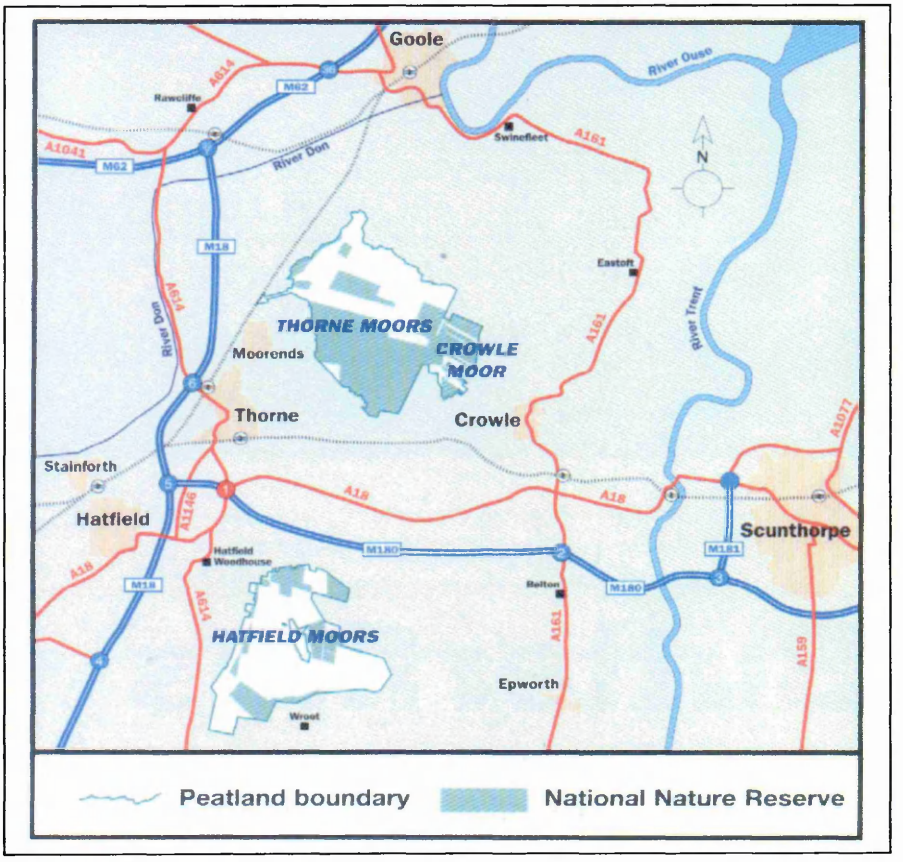


Figure 7.17: **Schematic map of the raised mires of Thorne and Hatfield Moors.** (Source: English Nature).

Figure 7.18: Raised mire habitat at Thorne Moor. (Source: English Nature)

The soils of the area are rich and intensively farmed in large, geometric fields typically divided by dykes. Agriculture is maintained by extensive pumped drainage systems and rivers have been re-aligned and canalised. The process of drainage is conspicuous by the containment of rivers within flood embankments, networks of ditches, dykes, canals and pump houses. Other than in the larger settlements employment in the area is extremely farm-reliant revolving around the farm, packing stations, food processing and supply and related, ancillary industries. The decline of coalfields associated with the area has created severe levels of unemployment. Several significant areas of remaining wetland still retain considerable environmental and archaeological resources (Countryside Agency, online, undated). The Initiative seeks to discover new, economically viable and environmentally sustainable approaches to land and water management. Water management is critical for many of the interests within the *Levels*. In particular settlements depend on adequate flood defences; domestic, agricultural and industrial users make significant demands on water abstraction; drainage is important for arable production and water availability is essential for wetland heritage and conservation. Water management issues are therefore critical for many interests groups but all with different perspectives. It is hoped that by working together these groups can find shared solutions to shared problems and conflicting objectives. The key outcomes of the project are shown in **Figure 7.19**.

The key outcomes of the project are:

* a set of objectives for sustainable water and land management in arable areas which integrate economic, social and environmental issues;
* practical methods of achieving the defined integrated objectives;
* proof that alternative management of water could bring environmental, social and economic benefits of high value;
* practical ways of implementing the EU Water Framework Directive will be demonstrated;
* recommendations will be made concerning the changes required to other policies to assist and add value to implementation of the Directive;
* an analysis of the potential for the Internal Drainage Boards to have a broader role in water management.

Figure 7.19: **The key outcomes of the *'Value in Wetness'* project.** (Source: Countryside Agency, online).

Alongside these outcomes it is expected that significant public benefits will be produced. These are shown in **Figure 7.20**.

Public benefits of the project should include:

* sustaining and creating landscapes that are rich in local character and distinctiveness;
* conserving the historic and archaeological fabric of the landscape;
* working to achieve local, national and international biodiversity targets;
* providing better access and recreational opportunities for public enjoyment.
* ensuring sustainable management of water, air and soil;
* maintaining viable rural communities.

Figure 7.20: **Public benefits that should accrue from the *'Value in Wetness'* project.** (Source: Countryside Agency, online, undated).

To achieve these aims a five-year action plan for selected farms has been embarked upon which involves the voluntary participation of all stakeholders to agree objectives, run a series of land use experiments, map the water network and associated wetland sites and to monitor water levels and quality. A further outcome will be to influence Government policy development relating to drained arable areas (Countryside Agency, online, undated).

7.2.4.4 Rother Valley Wildlife Strategy.

In 1994 a partnership between Derbyshire CC, Sheffield MDC, Rotherham MBC, Chesterfield Borough Council, North East Derbyshire Council and the District of Bolsover initiated an attempt to protect and enhance wildlife habitat on the River Rother and developed the ***Rother Valley Wildlife Strategy***. It was judged that as a result of many years of development and pollution, the Rother and its tributaries now contained only small remnants of the attractive landscapes that once characterised the area. Much of the valley floor would have been used as permanent grazing pastures before flood prevention schemes or agricultural drainage and improvement altered them. It is suggested (Rotherham, undated) that these pastures would have been under standing water in the winter months and some poorly drained areas may well have formed extensive marshlands.

Because industrial development in the area was now in decline and pollution problems were decreasing it was felt that the use of available grants would allow enhancement of both the wildlife and recreational potential of the river course and its environs. The *Strategy* provides guidance and coordination of any projects. **Figure 7.21** shows the boundary of the *Strategy* area and **Figure 7.22** identifies its key wildlife sites.

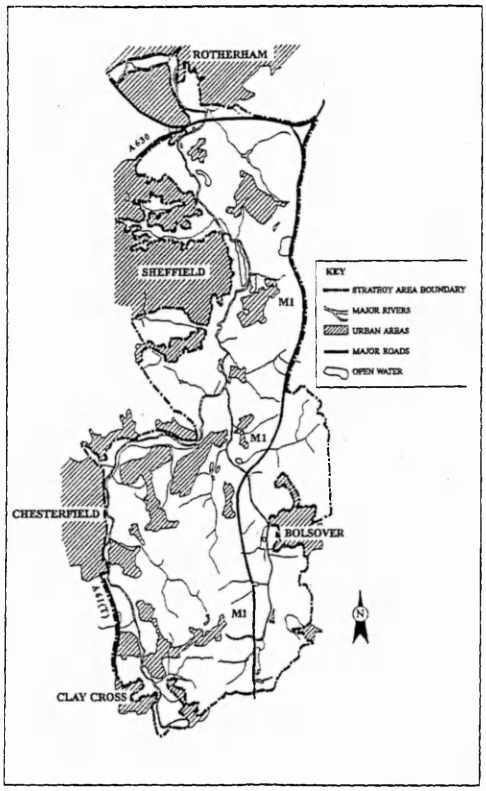


Figure 7.21: **Boundary of the River Rother Wildlife Strategy Area.**
(Source: Anon., 1994c)

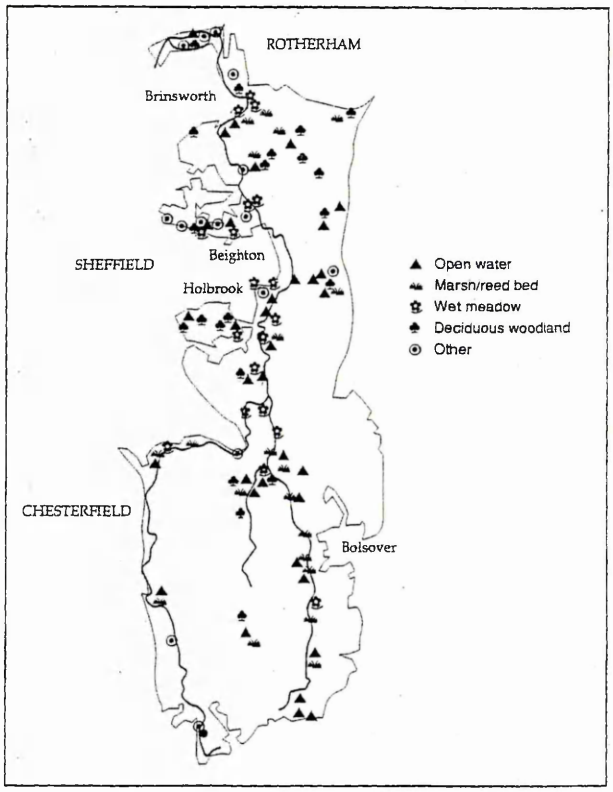


Figure 7.22: **Key wildlife sites.**

Whilst recognising the major constraints on enhancement of the river catchment for wildlife the *Strategy* (Anon, 1994c) does identify key issues that must be addressed and these are shown in **Figure 7.23**. Three of the case study projects discussed in this report lie within the *Strategy* area – Blackburn Meadows nature reserve, Rother Valley Country Park and Woodhouse Washlands nature reserve.

Key issues for the Strategy:

* to recognise the importance of the River Rother area for wildlife, both for its individual habitats and at a strategic level as a major wildlife corridor;
* to address the continuing loss of habitats in the valley;
* to recognise the impact of the loss of individual areas of wildlife habitat on the strategic resource;
* to consider means by which the further potential of the *Strategy* area for wildlife can be realised;
* to encourage and enable management of existing habitats to favour the species of fauna and flora for which the area is important;
* to campaign for, and promote, further environmental improvements, particularly a reduction in pollution emissions, for the benefit of wildlife;
* to recognise the importance of coordination of efforts for the benefit of wildlife by all local authorities and other agencies active in the *Strategy* area, and coordination with agencies and authorities outside the *Strategy* area at a local and national level;
* to promote the importance of the River Rother area for wildlife amongst other agencies.

Figure 7.23: Key issues for the Rother Valley Wildlife Strategy. (Source: Anon., 1994 c).

7.2.4.5 Local Environment Agency Plan for South Yorkshire and North East Derbyshire.

Local Environment Agency Plans (LEAPs) are non-statuory, integrated local management plans for identifying and assessing, prioritising and solving, local environmental issues related to the functions of the Environment Agency. Outcomes include a local programme of integrated action for environmental improvement in order to optimise benefit for the local environment. They claim to fulfil the Agency's contribution to sustainable development and promote openness and accountability. They should provide an effective focus for partnerships and help develop closer links with local communities and organisations (Environment Agency, 1998 [a]). However, the LEAPs have no binding force, but form a point of reference for decision making and ensure that its rationale becomes transparent . They provide an analysis of the state of the waters, in terms of quality, quantity and demands, and provide a consultation with both user groups and government bodies (Anon., 1997).

LEAPs evolved from ***Catchment Management Plans*** (CMP) which the National Rivers Authority hoped would integrate planning for all its functions (i.e. flood defence, water resources, fisheries, conservation, navigation, recreation and water quality). Key elements of the CMPs were to consult at various levels (but mainly with 'stakeholders' not the general public), to make information available, to set targets for water quality, quantity and physical features, to formulate action plans to achieve these targets and to identify partnerships. Crucial to the CMPs was that they must appear to be achievable whilst still promoting a long term vision (Environment Agency, online, undated [e]). The CMPs should assess resources, uses and activities, provide solutions to conflicts of uses, and plan for the avoidance of future environmental damage (National Rivers Authority, 1995). The plans were not universally accepted by internal management as the balance between benefits and costs was not fully promoted (Environment Agency, online, undated [e]). LEAPs are based on local river catchments. In 1997 the Environment Agency office in Leeds published a detailed consultation report for a ***Local Environment Agency Plan for South Yorkshire and North East Derbyshire*** - based on the catchment of the River Don and its tributaries. Containing a detailed description of the catchment (mirrored in Chapter 3) the document highlighted a set of key opportunities. These are (in relation to the watercourses and wetlands) shown in **Figure 7.24**.

Key opportunities identified in the LEAP:

* further improve the quality of the area's environment by reducing pollution from industry, contaminated land and sewage treatment systems;
* physically improve river channels and create habitats for wildlife in collaboration with local communities and environmental groups;
* manage the impact of water abstraction and compensatory flows to optimise the benefit for all existing and potential users;
* recognise and develop the importance for recreation, particularly for local people;
* maintain and improve protection of people and property from flooding;
* maintain effective links with the land use planning system to achieve integration of the aims of the plan with strategic and local land use plans

Figure 7.24: **Key opportunities identified in the South Yorkshire and North East Derbyshire LEAP.** (Source: Environment Agency, 1997).

LEAPs were envisaged to be annually reviewed with a new plan being incepted every five years. This process is outlined in **Figure 7.25**.

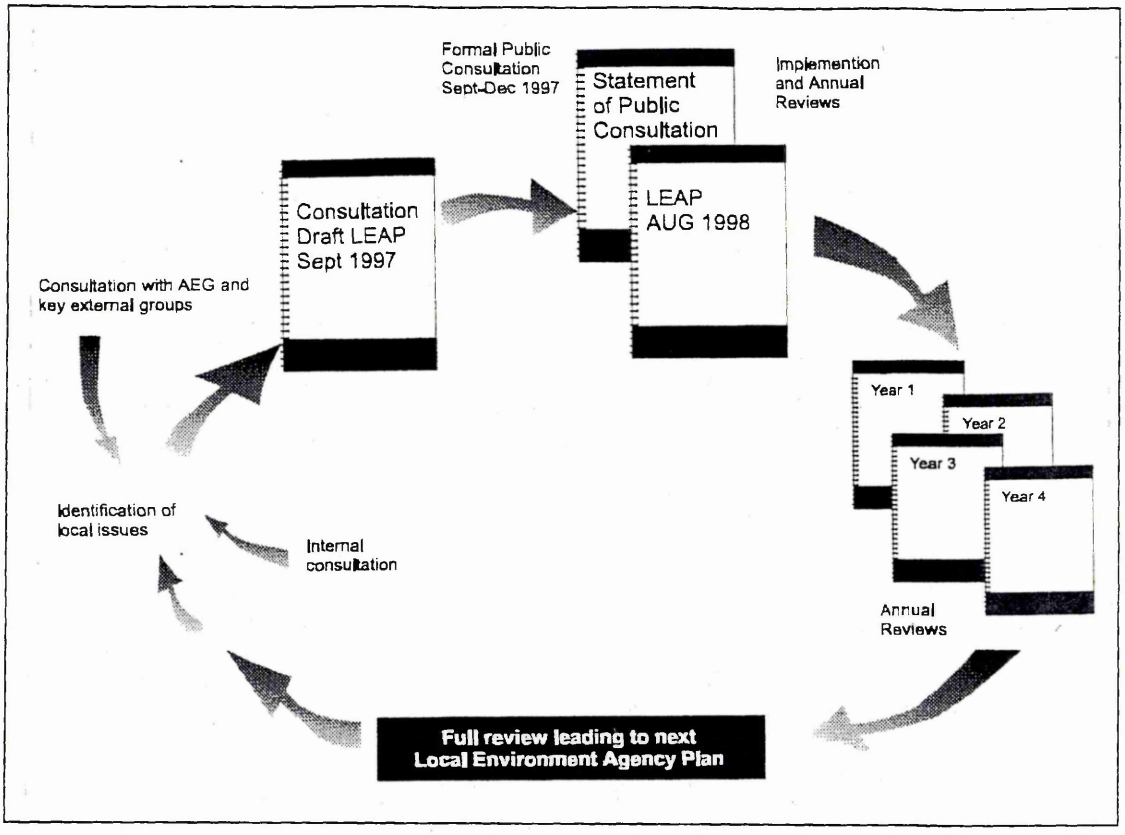


Figure 7.25: **The LEAP process and the main outputs in the five year cycle.**
(Source: Environment Agency, 1998 [b])

However, it would appear (from conversations with various Environment Agency staff) that LEAPs have not been as productive as was first envisaged, mainly due to shrinking resources to carry out projects. There is obvious disillusionment with this as expectations had been high that exciting and innovative projects would be achieved. It has been suggested that the LEAPs further evolve into ***Local Environment Action (not 'Agency') Plans*** which would act as a 'map' to set out a holistic view and vision for the local environment, linked to a range of activities, outputs and outcomes. Detail on this is not yet available (Anon., 2000 [b]). However, the Agency has recently (1999) introduced ***Catchment Abstraction Management Strategies*** (CAMS) the role of which is shown in **Figure 7.26**. They are intended to complement LEAPs (Environment Agency, online, undated [e]).

The role of CAMS is to:

* make information publicly available on water resources availability and licensing within a catchment;
* provide a consistent and structured approach to local water resources management, recognising both abstractor's reasonable needs for water and environmental needs;
* provide the opportunity for greater public involvement in the process of managing abstraction at a catchment level;
* provide a framework for managing time-limited licenses;
* facilitate license trading.

Figure 7.26: The role of Catchment Abstraction Management Strategies.
(Source: Environment Agency, online, undated [e]).

In 1993 the UK Government published guidance stressing the importance of a strategic approach to planning river and water management. Following the autumn 2000 floods it was agreed that studies should be initiated to prepare ***Catchment Flood Management Plans*** (CFMPs). These will provide a large-scale strategic planning framework for integrated management of flood risks to people and the developed and natural environment in a sustainable manner. This will be applicable to all catchments subject to flood events, including the Don.

7.2.4.6 The Don/Dearne Green Corridors Strategy.

Subtitled ***2020 Vision for Don and Dearne*** this strategy evolved from research into the problems of dramatic industrial decline in the region in the late twentieth century which resulted in serious and widespread social deprivation, economic decline and environmental degradation. Most of these issues were most apparent along the river and railway corridors of the area. The Yorkshire and Humber regional office of the then Countryside Commission (now the Countryside Agency) identified a need to establish a view of where various strategies, plans and projects promoted by various agencies, linked together or not. The early research had identified that at least £1 billion of investment connected with regeneration and environmental improvement was planned over the forthcoming five years. It was clear that the maximum benefit could most cost-effectively be achieved through an integrated approach by all those involved. Drawing together various stakeholders in the area the Commission proposed an integrated strategy to pursue the delivery of an environmentally sustainable regeneration of the

Don and Dearne corridors. The initiative created a 'prospectus' for the Don and Dearne green corridors which is shown in **Figure 7.27**.

The prospectus is intended to:

1. Integrate policy and action to pursue environmentally sustainable regeneration by addressing issues relating to:
   * environmental policy and strategy (environmental rejuvenation);
   * the interaction between the environment and the economy (sustainable economic development);
   * the interaction between the environment and the community (socio-environmental revitalisation).
2. Help market the Don and Dearne for new and exciting business and tourism investment and development.
3. Provide a framework for strategic bidding and enable projects to clearly establish their strategic context.

(Source: Countryside Commission, 1997).

Figure 7.27: The Don/Dearne Green Corridors prospectus.

It is thought that despite waning interest from key stakeholders the project had some influence in how regeneration funding was directed and applied, particularly in the Dearne valley. The project now seems to have been 'shelved' as new initiatives have focused attention on other strategic areas.

7.3 Social issues.

In the 1980s it was recognised that conservation strategies must take heed of the recreational, aesthetic and inspirational aspects of nature conservation sites alongside their scientific and educational values (Mabey, 1980; Ratcliffe, 1981 and the Nature Conservancy Council, 1987). Box (1986) suggests that modification of landscapes by nature develops maturation in the way they are seen by people, often combined with the use of the site for informal recreational purposes. Mackay (online, 2002) suggests that a number of social benefits can arise from people taking part in open-air recreation. These are listed in **Figure 7.28**.

Benefits of taking part in open-air recreation:

* escaping from the pressures of modern living – gaining relaxation, refreshment and challenge, and thus helping reduce anxiety and stress levels;
* finding better opportunities for social interaction – meeting people or going out in small groups, and thus helping to enhance community;
* a more socially inclusive society – walking and cycling are inexpensive activities and better access opportunities close to urban areas means that people without a car can visit and enjoy the countryside.

(Source: Mackay, online, 2002).

Figure 7.28: The benefits of taking part in open-air recreation.

This is an attempt to place a social value on an environment but the process of applying it is an extremely intangible concept. Burgess and Gold (1982) suggest giving value is to refocus attention on the close and enriching affective bond between people and the environments they create, inhabit, manipulate, conserve, visit or even imagine. But that it is extremely difficult to express this value because it is based on personal experiences and associated emotions. In simple social survey test procedures questions asking respondents to describe what an environment feels like can reduce the quality of the experience to platitudes and clichés. Rohde and Kendle (1994) demonstrate impacts on psychological well-being under five main headings shown in **Figure 7.29**.

Classifications of the impact of nature on psychological well-being:

* emotional (e.g. through reduction in stress and an increase in happiness);
* cognitive (e.g. through reduction in mental fatigue);
* developmental (e.g. through encouraging higher levels of mental activity, especially among children);
* behavioural (e.g. through encouraging explorative and adventurous behaviour, which in turn can support or build self-esteem);
* social (e.g. natural settings can facilitate contact, encourage conversation across social boundaries and even, in some cases, engender a broader social concern).

(Source: Rohde and Kendle, 1994)

Figure 7.29: Classifications of the impact of nature on psychological well-being.

It has been suggested that there can be links between these improved psychological states and physical health. Ulrich *et al.* (1991) have examined the effect of stress as a major contributor to many of the health problems in modern society. Following the assertion of many conservation professionals that being in contact with nature promotes a sense of well-being Ulrich and his colleagues have attempted to produce scientific evidence to support this contention. Their technique has been to subject volunteers to a period of stress using anxiety-raising videos or simulated stressful car journeys through unpleasant and threatening environments. The volunteers are then visually transferred to a 'green' environment and the impact on muscle tension, blood pressure and electrical brain activity is monitored. The experiments have shown measurable relief of stress in these circumstances resulting in greater productivity at work and less conflict at home.

Clark and Burgess (1999) suggest that it is now widely accepted that decisions about environmental policies and projects should not be made on scientific and/or economic grounds alone; social and cultural aspects also need to be taken into account. They report that some aspects of this are becoming increasingly popular through processes like that of Local Agenda 21 initiatives. In a 'Public Attitudes to the Countryside' survey in 1998, the Countryside Agency have found that one in three people are concerned about the quality of the countryside. Respondents to the survey listed sense of freedom and open space, peace and quiet, contact with nature, fresh air and the 'greeness' of the place as the most significant characteristics that they like in the countryside. For nearly half the respondents the single most important benefit from visiting the countryside is the sense of relaxation and well being it gives them (Anon., 1997).

In their research at a site in North Devon, in tandem with a scientific/economic evaluation of the same site, Clark and Burgess (1999) aimed to develop and test a deliberative procedure for eliciting wetland values which could provide both qualitative and quantitative data to provide policy makers with relevant information for wetland policy and management. It was concluded that:

* the studies could not reveal the full range of wetland values;
* more widespread awareness of wetland functions needs to be promoted;
* economic valuations cannot subsume social valuations, and vice versa;
* it is crucial that sound scientific knowledge and local knowledge inform both economic and social scientific approaches;
* it is crucial that the evaluation of projects is not confined to a single approach, be it economics, social or scientific.

Building on this theme, in synthesising the results of a series of seminars on implementing the WFD, WWF(2001) have outlined the benefits of public and stakeholder participation for achieving the WFD objectives. These are listed in **Figure 7.30**.

The benefits of public and stakeholder participation for achieving the WFD objectives:

* there is a better chance that the key water management issues at the river basin level are correctly identified and agreed upon;
* the knowledge, experience, aspirations and concerns of local communities are built into the River Basin Management Plans and Programme of Measures from the beginning;
* the Programme of Measures is more likely to be politically and culturally realistic and acceptable;
* any potential conflicts can be minimised or avoided;
* implementation costs are likely to be lower when existing stakeholder knowledge and know-how is applied to avoid potentially costly errors and/or duplication of information;
* there is a better chance that both regulatory and voluntary approaches will be enforceable if they have been developed in partnership with stakeholders.

Figure 7.30: The benefits of public and stakeholder participation for achieving the WFD objectives. (Source: WWF, 2001).

Burgess and Gold (1982) suggest that people will search for environments that will satisfy basic needs such as shelter and sources of sustenance, but that they also value places which give sensual pleasure and mental stimulation, and others that give an indication of their past and of what the future may hold. Some people will be attracted to some environments and repelled by others.

A meeting in 1996 of the Contracting Parties of the Ramsar Convention recommended that specific efforts be made to encourage active and informed participation of local and indigenous people at Ramsar listed sites and other wetlands and their catchments, and their direct involvement, through appropriate mechanisms, in wetland management (Environment Agency, online, undated [c]).

The Environment Agency reports that it has also been found from case studies that the concept of identifying 'stakeholders' is extremely important (Environment Agency, online, undated [c]).

Sutherland (2000, p. 123) states that, *"consultation requires sensitivity and should take into consideration the culture of the relevant communities; nationalities and local communities differ as do groups such as politicians, landowners, farmers and other conservationists"*. The importance of this for local projects will be apparent in the case studies in the Don catchment outlined later in this study.

In line with 'wise use' principles the Local Environment Agency Plan is subject to a wide consultation process involving catchment user groups and the general public. The Agency states that consultation is a key element of the catchment management process. It is intended as a method for resolving the conflict of interests that exists between different users of the water environment by achieving compromise between all interested parties in an attempt to achieve the optimal planning solution (Environment Agency, online, undated [d]).

The Agency reflect Denny's (1994) concept of the need for education and awareness by stating that:

"The most important change in the future management of the river catchment is the increased opportunity for community involvement. Local community groups or individuals will be able to take part in all aspects of the vision. Greater environmental awareness will also bring with it more responsible citizenship as people become aware of their choices and the consequences of those choices. The Environment Agency cannot act on their own in pursuit of the vision. It requires careful planning, shared responsibility amongst the local community and all agencies agreeing to work towards a common goal" (Environment Agency, online, undated [d]).

As Sutherland (2000) suggests, a plan is most likely to be successful if:

* the need for it is understood by those involved and they are fully consulted during its preparation;
* there is a process of monitoring and review to adjust the plan if necessary;
* the resource implications have been considered so that the plan is realistic.

7.4 Economic issues.

Today, most planning and development decisions are made on economic grounds and particularly in relation to the forces of the free-market system. It would be unrealistic to ignore this when seeking the resources to conserve and manage wetlands when they can be so easily converted to some use that appears to be more economically viable and the water that feeds them diverted for another purpose. The purpose of this study is not to value individual sites in

such a way within the study area, but to recognise the importance of such valuations in the decisions that would have to be made about land use and resource allocation. One result could be that restoration, rehabilitation or creation of wetland features may add value to social and economic regeneration projects.

Before any such decisions could be instigated an attempt must be made to place some sort of quantitative value on wetland functions, goods and services. Winpenny (1991) states that the environment is not 'free', even though there may not be a conventional market for its services. Newson (1992 [b]) argues that value is a topic for politics, not economics, but it is recognised that some attempt be made to aid economic processes and decision-making. However, some of these values are easier to quantify than others. For instance, Blasco (1996) suggests that for many products, such as fish or timber, there is a world market and thus a relatively easy calculation of the worth of the wetland. Equally, it is relatively easy to place a value on water quality improvement as a function of a wetland by calculating the cost of building a treatment works which would perform the same function. But it is much more difficult to value biodiversity or aesthetic beauty. Barbier *et al.*. (1996) also suggest that some forms of recreation, a site's archaeology and the cultural/religious significance of some wetlands are also difficult to quantify. Hanley (1989) illustrates this by commenting that environmental valuation is extremely difficult due to the incredible complexity of ecosystems and their functions. Barbier, Burgess and Folke (1994) describe direct uses of wetlands in terms of being consumptive (such as livestock grazing, agriculture, hunting and fishing) or non-consumptive uses of wetland 'services' (such as recreation, tourism, education and navigation). They, and other authors such as Winpenny (1991), also suggest that some values may be hidden despite supporting other, more measurable values. For example the ground-water recharge function of flood plain wetlands may have indirect use value through replenishment of aquifer systems that supply water for domestic use and agriculture. But this contribution is non-marketed, is financially unrewarded and is only indirectly connected to economic activity.

Barbier *et al.* (1996) also comment that there is always a choice or option for the management of environmental resources - to leave them in their natural state (and subject to ongoing influences), to allow them to degrade, or to convert them to some other use. Each choice has implications in terms of values gained or lost. Pearce and Turner (1990) point out that wetlands are multifunctional resources and that some of the multiple uses conflict with each other. They also comment that non-integrative government policy and even inefficient government interventions have resulted in 'created' use conflicts and consequent sub-optimal wetland protection levels. Barbier *et al.* (1996) continue in saying that the decision as to what use to pursue for a given environmental resource can only be made if the values that are gained and

lost are properly analysed and evaluated for each option choice. Lowe and Lewis (1980) state that the cost of a resource to society is equal to the value of its use in its most beneficial, alternative role.

As a major hydrological element of the river basin system, wetlands are extremely complex and dynamic systems. The Ramsar Convention distinguished between 35 different categories of wetlands indicating the wide diversity of different functions wetland ecosystems may serve (Barth, 2000). If the functions of wetlands are to be recognised elements of integrated river basin management planning and development then some key issues need to be considered. These are listed in **Figure 7.31**.

Key issues need to be considered in terms of the functions of wetlands are to be recognised elements of integrated river basin management planning and development:

* wetlands only serve their functions when the related ecological processes are largely undisturbed and their water needs are satisfied.
* wetlands belong to the most productive ecosystems with an extremely rich biodiversity.
* wetlands can act as important purification agents for surface and groundwater.
* wetlands are important for the ecological processes of all aquatic ecosystems.
* wetlands are very effective natural retention areas for floods.
* wetlands are important for recreation and amenity.

Figure 7.31: **Key issues need to be considered in terms of the functions of wetlands are to be recognised elements of integrated river basin management planning and development** (Source: Barth, 2000).

The U.S. Department of the Interior (1994) has reported that 33% of their nation's endangered or threatened species live in or are dependent on wetlands.

In the United States many wetlands are in private ownership and the normal tendency of this private market is to encourage the conversion of wetlands to other uses. Wetlands constitute a classical example of market failure for the reasons shown in **Figure 7.32**.

Reasons for market failure of wetlands:

* the wetland owner generally cannot reap the benefits of his resource for his own use or sale;
* the flood protection benefits of wetlands are realised by owners and others downstream;
* many of the fish and other wildlife that breed in the wetlands migrate and are caught or enjoyed by others;
* the ground water recharge and sediment trapping benefits cannot be commercially exploited.

Figure 7.32: Reasons for the market failure of wetlands.
(Source: U.S. Department of the Interior, 1994).

So it is perceived that the only way a wetland owner can benefit economically from his resource is to alter and develop it. This means that the system of wetlands in any country is quite vulnerable (U.S. Department of the Interior, 1994).

The increase in the rate of transformation of wetlands for agricultural purposes still persists alongside continuing agricultural subsidies and surpluses. In urban and urban-fringe settings natural flood plains are under threat as drier land becomes scarcer and wetlands emerge as some of the least expensive areas in which to locate. Increasingly residential, industrial, commercial and infrastructure developments are seen in these areas. However, despite such increasing pressure on flood plains, Barth (2000) suggests that within the EU Water Framework Directive the economic analysis that is required as a basis for the design of the programme of measures, and in particular to optimise its efficiency, can help to assign an economic value to wetlands. This will demonstrate their economic relevance in order to improve water status in each relevant river basin management plan.

At the WWF seminar on the role of wetlands in river basin management, Seffer (2000) presented a case study on the economic value of flood plains in the Danube basin, giving particular attention to the Morava River and its associated meadows. The river forms the border between the Czech and Slovak Republics, and Austria. Seffer described the main functions of the Morava flood plain grasslands and these are shown in **Figure 7.33**.

The main functions of the Morava flood plain grasslands:

* flood control is secured by the retention capacity of the flood plain which can accommodate more than 100,000,000 cubic metres on the Slovak side;
* regularly mown meadows are unique in terms of acting as nutrient sinks;
* because the flood plain is high in nitrate and low in oxygen, a high microbial denitrification rate can be expected;
* the productivity, in terms of biomass yields, of the wetlands is very high;
* the meadows provide important sources of food and habitats for a wide range of birds, including many rare and endangered species, and it is one of central Europe's major nesting and wintering sites.

Figure 7.33: The main functions of the Morava flood plain grasslands. (Source: Seffer, 2000).

Following research to calculate the benefits of the nitrogen sink in the lower part of the flood plain's species-rich meadows, Seffer (2000) completed a cost-benefit analysis of investment in the restoration of arable lands in the meadows of the flood plain. After economic valuation of nitrate abatement, outcomes suggest that wetlands can play a significant role in fighting non-point source water pollution in agricultural landscapes. His research also confirmed that the identification and estimation of future economic benefits from sustainable use of protected areas may be a positive incentive for restoration of degraded habitats.

Harley and Hanley (1989) report on a study they carried out on behalf of the RSPB who were investigating the economic benefits of conservation. The study examined three quite different RSPB nature reserves and considered two differently understood meanings of the term 'economic benefits'. The first was to examine the additional income generated locally due to the existence of the reserve and the second was to value 'willingness to pay', either for the continuance of the reserve or in terms of travel costs. Although significant results were obtained there were also significant issues raised as to the value of the results, the comparability of them and the need for other 'tests'.

Changes in agricultural practices could be crucial in economic terms, particularly in view of changing crop patterns with climate change, changing markets and releases of land from production. The use of buffer zones alongside water courses and wetland features could be promoted to prevent diffuse pollution, loss of riparian vegetation and loss of faunal habitats through seepage and leaching of pesticides and herbicides. Fencing of such zones prevents

grazing on the water's edge. This eliminates bankside erosion and 'poaching' with their consequent loss of riparian vegetation and faunal habitats. Restricted watering access can be provided within the exclosure areas.

Opportunities for agricultural economic diversity can exist with greater promotion of agri-environment projects and the potential of Countryside Stewardship to compensate for loss of production. Use and management of specialised livestock for management of natural heritage areas can provide recreation and tourism opportunities for farmers and landowners as well as a growing market for rare breed produce. Equally, there is a growing interest and market for traditional crafts such as charcoal production from riparian woodland, thatch from reeds and sedges, and other products such as hurdle fences and rustic furniture. This, in turn, can provide a tourism enterprise.

Pearce and Turner (1990) comment that there is a growing awareness that most wetlands are more valuable economic resources in their natural, or only slightly modified state, than if radically altered and intensively managed. Despite this, they suggest that wetlands are still not being managed in an economically optimal way. They explain this by suggesting that wetland resource users are still not being given appropriate economic signals which reflect the full social costs of their utilisation.

Recent research (Balmford *et al.*., 2002) by a collaborative team of scientists and economists from the United States and the United Kingdom, has examined five case studies of differing habitats in different parts of the world that have been converted to other uses (one of which was a Canadian freshwater marsh). The result of the study has shown that, although there may be short-term economic benefits from the conversion of the natural habitat to farmland, pastures, fish farms or any other artificially engineered landscape, it can result in a catastrophic collapse of income for the wider community. The report's findings show that the draining of the Canadian freshwater marsh in one of the country's most productive agricultural areas yielded net private benefits (mainly due to substantial drainage subsidies). However, social benefits of retaining the wetlands, arising from sustainable hunting, angling and trapping (and not valuing recreational, aesthetic or flood control considerations) greatly exceeded agricultural gains. The total economic value was higher when the wetland remained intact, exceeding figures for conversion by a mean of approximately 60%. Further work in the study found three broad, interrelated reasons why natural ecosystems are still being lost despite their overall benefits to society. These are shown in **Figure 7.34**.

Reasons why ecosystems are lost:

* failures of information - for many services there is a lack of valuations of their provision by natural systems, and particularly of changes as human impacts increase;
* government subsidies and tax incentives that encourage development based on economic policies that reflect previous, outdated economic climates and exacerbated by this lack of information outlined above;
* the conversion activity made narrow economic sense for investors.

Figure 7.34: Reasons why ecosystems are being lost. (Source: Balmford *et al*, 2002)

The RSPB, through the EU LIFE project on the Wise Use of Wetlands, states that Article 7 of the Water Framework Directive requires economic analysis within the river basin. The specific foci for this analysis are shown in **Figure 7.35**.

Specific areas to be addressed according to Article 7 of the Water Framework Directive required for an economic analysis within a river basin:

a) abstraction and distribution of fresh water;
b) collection and discharge of waste water;
c) volumes, prices and costs (including environmental and resource costs and benefits) associated with a) and b) above;
d) the breakdown of the above by economic sector;
e) long-term forecasts of supply and demand;
f) estimates of investment in infrastructure;
g) historical trends in the above (for at least six years) and future projections under different price and investment scenarios (for twelve years).

It also states that the appraisal will need to reflect the wider aims of the Directive:

* to achieve 'good status' for all surface waters and groundwaters;
* alleviation of the risk and impact of flood and drought;
* the need to achieve objectives for defined Protected Areas.

Figure 7.35: Specific areas to be addressed in Article 7 of the Water Framework Directive required for economic analysis within a river basin. (Source: Anon., online, 1999 [b]).

The Framework, applied at a catchment level should be able to address economic, social and environmental costs and benefits in a comprehensive way; cover the full range of use/function and non-use values associated with wetlands; incorporate economic, social, hydrological, ecological and environmental data; consider different scenarios for trends in water use, economic development; and incorporate community participation in decision-making processes.

The office of the WWF European Freshwater Programme propose that policies and financial instruments do not operate in a vacuum, but against a highly complex web of inter-related factors and processes, many of which are economic by nature and may be influenced by factors well beyond the area of interest. This means that it is often difficult to isolate the precise role played by a given policy or financial instrument in a particular flood plain area. Many policies are also subject to national and regional interpretation and this can lead to both positive and negative outcomes dependent on national or regional perceptions, understandings and priorities. Until flood plain restoration is recognised for its positive economic and social benefits, and the regulatory aspects of the Water Framework Directive are effectively policed, it is unlikely to be a priority for these authorities (Anon., 2000d).

Finally, it may be that future environmental gains may have to be paid for in some way, effectively working to the 'carrot' rather than the 'stick' approach. Daily and Ellison (2002) suggest that market creation of services to benefit the environment already exist, and quote the example of Scandinavian governments paying for technological improvements in Baltic power stations to reduce the impacts of acid rain. In a wetland scenario it may be that wetland owners may be rewarded for the filtering of water supplies and the regulation of effluent. They argue that the environment generates services that have an economic value. Paying for those services provides an open recognition of the worth of those environments, and the resulting prices provide incentives for conservation. This proposition does not sit well alongside arguments for the 'polluter pays' principle.

7.5 Summary of findings.

In relation to the questions being asked in the research study the key documentation that affects strategic policy formation should have significant influence on site selection and prioritisation for allocation of funding and resources. A past mentality of a need for self-sufficiency and economic and industrial progression has left an inheritance of pollution, land use changes, intensive land management and acquisition of land for development. Environmental concerns in this era have increasingly been the 'poor relation' of this thrust for economic stability. in the last

thirty years or so major changes have occurred in the economic structure of the world, leading to the decline of major industries in the UK and major changes in the markets, functioning and funding of agriculture. Alongside this there has been a growing sense of disturbance amongst many people that the environment needs to be at the heart of decision-making with a greater emphasis on conservation. Much of the policy relating to the subject area has occurred in this latter era and is more focussed towards a balanced view of integrating development with the environment.

It is very evident that a strategic hierarchy theoretically exists of a 'trickle down' system of tiers of levels of international influence through to local implementation. However, strategic planning appears to be haphazard. As already stated the review of the key documentation has identified a need to integrate conservation into policy formulation and development planning and key policy recommendations have been developed alongside increasing site protection and the fact that land is becoming available for projects as a result of industrial decline and changing agricultural practices.

Of particular importance have been European Union Directives that have stimulated governmental attention to environmental issues. The future of wetland protection, enhancement, management, rehabilitation and creation is significantly more hopeful if the EU Water Framework Directive achieves its potential to significantly change the recognition of the importance of regional strategies. The Directive promises, through its advocating of 'wise use' principles, significant benefits in terms of water quality, access opportunities and habitat enhancement. It also recognises the groundswell of interest in environmental issues and the pride people place in their own 'patch' by placing a significant emphasis on consultations with stakeholders, particularly including local indigenous people. These will identify key social issues.

But the Directive will require a significant change in the culture and working practices of the agencies involved in implementing it as the creation of River Basin Districts will see problems in relation to crossing administrative boundaries. It will also place a different emphasis on regulation and project funding thus encouraging cooperation between previously competing authorities and agencies particularly in view of the fact that there are questions as to whether existing regional, cross border strategies are effective. However, examples of good practice are beginning to surface and the '*Value in Wetness*' project in the Humberhead Levels Initiative has great promise in being such an example of a truly integrated approach to land management.

A further significant and developing policy direction change is the reform of the EU Common Agricultural Policy which, in relation to changing funding structures and changing markets, may open opportunities for more sensitive management and development of wetland environments. There may also be opportunities for wetland developments on land that becomes available as there is an expected release of land from agricultural usage.

In terms of policy development highlighted in this review there appears to be a growing concept of integrated planning which will become prescribed action in regional development and catchment or river basin planning. But major changes in land use will involve close scrutiny of the costs and benefits of such changes in economic, social and environmental terms. There are difficulties in valuing the services, functions and processes provided by wetlands and in identifying what the products of these are and how can they be valued.

Policy is often developed as the result of perceived threat. One aspect of this has been identified above in relation to growing concern of the voting public in relation to the degradation of the environment around them. But the past few years have also highlighted the growing problem of the possibility of significant climate change and its potential effects on agricultural practices, land use, flood events and habitat and species diversity. Research is currently in progress on the short and long-term effects on these. This will no doubt result in policy development to cater for such changes. In terms of the subject area of this study there are already indications of land use changes as large areas of agricultural land will be needed for flood retention cells. With a large section of the Don catchment being low-lying, and some of it tidal, there is likely to be a need for changes in flood management policy and techniques.

Further links to changing policy have been identified in the documentation in relation to increasing recreational needs from the countryside and wetland areas in particular. There is also a growing realisation associated with this, that contact with nature and the countryside are essential to physical health and psychological well-being, particularly in urban areas.

Later chapters will pay attention to, and discuss, these possible future changes in the catchment.

8.0 THE CASE STUDY PROJECTS.

8.1 Introduction.

The descriptions of initiatives for rehabilitation of the Rivers Rhine and Danube in **Appendix 1** provide a good basis for examining case study projects in the River Don catchment. There are obvious successes in these two major transnational projects that demonstrate good practice in terms of cooperation and organisation. The implementation of the Water Framework Directive will have significant effects on the way local authorities, other agencies and the voluntary sector will have to cooperate in the Don catchment. As will be seen from some of the interviews with key personnel in the next chapter, this will be a major culture change from existing working practices which are often insular and competitive. The case studies demonstrate attempts by the project managers to involve stakeholders, including the local communities, a greater emphasis on this will be crucial to comply with the WFD.

As is apparent in the *Chapters 1, 2 and 4*, through recent history the River Don catchment has provided the means for industrial development in the region. In association with this, there has been a rapidly expanding population around the urban centres of Sheffield, Rotherham, Barnsley and Doncaster. This placed increasing pressure on the more rural parts of the lower catchment for urban fringe land uses such as housing, road building, quarrying and landfill (Moss, 1995). Heavy industry is now in decline, and the population has more time for, interest in, and access to, leisure pursuits. Sites for nature conservation within and around urban areas play a major part in providing access to nature. Through this visitors to such sites can gain an experience that imparts a conservation message which is important in today's individualist and consumerist society. Such contact with nature is also increasingly seen as vital for quality of life, and the 'green' backdrop to regeneration and economic development is now recognised to be of potential economic significance.

The legacy of pollution, particularly from steel, coal mining and fuel production includes large areas of contaminated land, and poor quality of both air and water. The dereliction that followed the decline of traditional heavy industries (often sited alongside rivers for water power and water cooling) has opened up new opportunities for reclamation and regeneration. These include, and may well be enhanced by, both nature conservation and recreational features (Rotherham and Cartwright, 2000).

To assess the impacts of wetland creation and management on economic and social regeneration, case studies across South Yorkshire were considered. The financial impacts relate

to initial start up (capital investment and grant aid draw down) of a facility such as a major nature reserve and visitor centre, or to aspects of their operation (revenue costs and generation, grant aid, commercial function and induced local impacts). The full potential impacts are not yet fully assessed, but capital impacts and some revenue issues can be appreciated from the case studies.

These projects provide a portfolio that is relevant and informative, presenting a range of scenarios from wetland management, to wetland restoration, to habitat creation; and from modest facility provision to major developments. All were initially justified on conservation and / or amenity provision grounds, although for Old Moor, consequent direct employment impact was a major lever in securing the grant aid.

The author has lived and worked in the region all his life and consequently has a good network of contacts in the industry sector throughout the catchment and thus has good knowledge of the range of suitable case study sites available. In addition to the above stated criteria, sites were chosen because of known good access to key personnel, known extensive documentary material, known diversity of initial development and particularly in their relationship to local economic and social regeneration.

8.2 The Region and the Case Study Sites.

During the 1970s and 1980s, the study region suffered a catastrophic decline in its core primary and secondary industries (steel, coal, cutlery, tool manufacture *etc*), and a consequent collapse in employment at the most basic levels. Steel-based employment in the Lower Don Valley in Sheffield for example, declined from 40,000 to 13,000 jobs between 1975 and 1988, along with a legacy of dereliction and despondency (Rotherham, Cartwright and Watts, 2000). In Sheffield, one response was to spark a new phase of 'greening' of the landscape combined with economic regeneration. From a nature conservation perspective, this could be a mixed bag, with ecologically interesting sites swept away and replaced by green grass and lollypop trees! To avoid this required a partnership between ecologists, planners, landscapers, academics, volunteers and politicians (Rotherham, Cartwright and Watts, 2000).

One of the innovations to emerge during this period, and to be taken up by all the local authorities in the region, was the idea of positive 'greening' and nature conservation / habitat creation as precursor to, and a lubricant for, economic renewal. In this context, this study considers contrasting case studies across the region. It draws some broad conclusions and presents some thoughts for future possibilities. The key issues for the northern part of the study

area, and relevant to the rest, were addressed in a series of three consultancy reports by the author and Chris Senior at Sheffield Hallam University in 1998: *Don and Dearne Green Corridors: Strategic Information Review*: *Paper 1: Social Conditions ands Community Aspirations*; *Paper 2: Economic Needs, Trends and Potential*; and *Paper 3: State of the Environment*. One conclusion of these reports was that '*the state of the environment is inextricably linked to the health of the local economy..... without significant improvement to the environment, both actual and perceived, the economic opportunities for the Don and Dearne would be seriously limited.' (Cartwright, Egan and Senior, 1998).*

Similar sentiments have been expressed about the southern region and in particular the River Rother catchment including large areas of North Derbyshire. The legacy of dereliction and of poor perception has massive implications for economic and social recovery (Rotherham, 1999). However, there is a further twist with regard to the perception of '*dereliction*' and of '*worth*'. This concerns the landscape, social and nature conservation values of some of our post-industrial sites. Unappreciated and unrecognised by planners and politicians, their major conservation and amenity potentials may be destroyed by misguided programmes of '*restoration*' and '*greening*', lubricated by a significant injection from the public purse. (Middleton, 2000; Rotherham, 1999; and Lunn, Rotherham and Spode, 2000).

The key elements of research into these case study sites are shown in **Figure 8.1**.

The case study research is designed to ascertain, where possible, and to later discuss:

* The strategic background to their inception;
* How the immediate opportunity to create them was realised - what were the key prime movers for action?;
* How was the location decided? - what criteria were used? Was the decision based on ecological priorities or land availability?
* How was the project initially funded and how will it continue to be funded?
* How comparable are the aims of the projects - are these linked to policies and strategies?
* Was a 'project champion' influential or even essential and what happens when such individuals move on?

Figure 8.1: Key elements of the case study research.

The case study sites are listed overleaf and shown in their South Yorkshire and River Don catchment context in **Figure 8.2**:

* Rother Valley Country Park, Rotherham;
* Woodhouse Washlands Nature Reserve, Sheffield;
* Blackburn Meadows Nature Reserve, Sheffield;
* Old Moor Nature Reserve, Barnsley;
* Potteric Carr Nature Reserve, Doncaster.

Figure 8.2: Locations of the case study project sites.
(Taken under licence from Ordnance Survey 1: 250,000 North Midlands and Yorkshire sheet 11, Revised to September, 1972. [Not to scale]).

All costings and other figures are based on information provided in 2000.

8.2.1 Rother Valley Country Park (Rotherham MBC), Rotherham.

8.2.1.1 General site description. (A location map is shown in **Figure 8.3**).

Grid Reference: SK 453 823

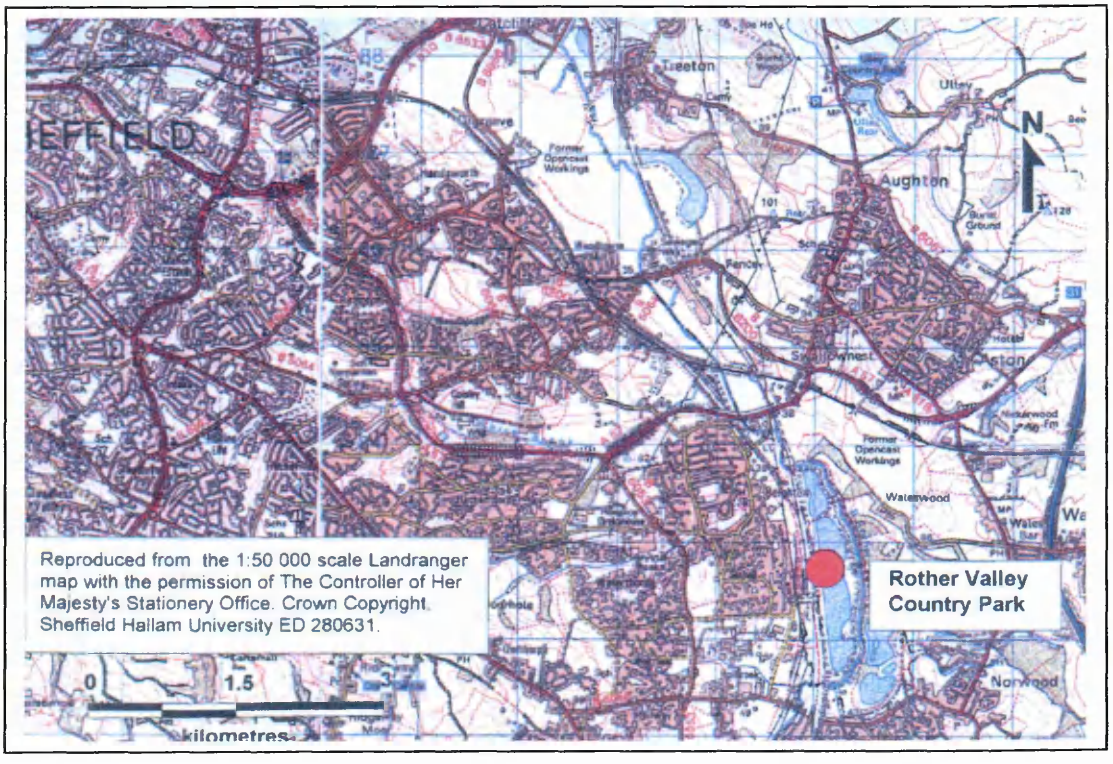


Figure 8.3: Location map of Rother Valley Country Park.

This is a major recreational/nature conservation facility developed in the 1980s on the site of the ancient Killamarsh Meadows, poor quality agricultural land and adjacent derelict collieries. It is now one of the top visitor attractions in South Yorkshire (between 600,000 and 800,000 visitors per year). **Figure 8.4** is a general aerial photograph of the completed development and **Figure 8.5** is a more focused view of the central buildings from which the park is administered.

Figure 8.4: Aerial view of Rother Valley park.

Figure 8.5: Rother Valley park centre.

(Source for both: Gareth Horne).

The park is a multi-use landscape catering for both formal and informal recreational pursuits, is a major landscape feature in the area, and acts as a haven for wildlife. Examples of the functions and facilities of the park are shown in **Figures 8.6 - 8.11**.

Figure 8.6: Golfing at Rother Valley park.

Figure 8.7: Windsurfing at Rother Valley park.

Figure 8.8: Canoeing at Rother Valley park.

Figure 8.9: Sailing in Rother Valley park.

Figure 8.10: Highland cattle in Rother Valley park.

Figure 8.11: Whooper swan in Rother Valley park.

(Source for all photographs this page: Gareth Horne).

8.2.1.2 Site history and development.

Formerly an extremely wet agricultural and 'waste' area the valley of the Rother at the site of the later country park had become a significant wetland site for wildlife and was known as the Killamarsh Meadows. In the early 1960s Sheffield was in desperate need of a large area of land for development to house its rapidly expanding population. Huge residential developments were planned for the districts of Mosborough, Beighton and Sothall in Sheffield and they began to expand as the new housing areas of the city. Rother Valley Country Park was first suggested in the 1960s as a 'green lung' and recreational resource for this expanding area. In view of this, in 1972 Sheffield City Council commissioned a feasibility study during which the National Coal Board's plan for opencast mining of the area was discussed so that its end use could reflect the desires for the park. Because the area envisaged was administered by the three local authorities of Sheffield, Rotherham and North East Derbyshire (and South Yorkshire County Council before it was abolished in 1986) a joint committee of the local councils was set up (Anon., online, undated [j]). Due to restrictions of funding and administrative boundary changes the park is now solely administered by Rotherham MBC. The main aim for the park is shown in **Figure 8.12**.

The corporate aim for the park of the Joint Committee was:
"To create an easily accessible park offering a safe and attractive land and water based environment which will cater for a wide range of countryside and recreation activities, available to a broad cross section of the community at both the local and regional level and the conservation of such resources for present and future generations".

Figure 8.12: Corporate aim of Rother Valley Country Park. (Source: Anon., online, undated [j]).

Opencast mining of the area covered a 300 hectare site and began in 1976 removing a total of 1.5 million tones of high quality coal by 1981. Following extensive public consultation a development proposal was formulated with three main objectives. The prime purpose of the site was to hold back flood waters in various ways dependent on the severity of the flood (Anon., online, undated [j]). The route of the River Rother was highly channelised as can be seen from the aerial photograph in **Figure 8.4** and the embankments to the river corridor were set back to provide extra capacity for flood waters. Under the bridge connecting the main administrative park to the entrance road a regulator bridge was installed which could be raised to hold back excessive flow in flood conditions and the river banks and water bodies in the park were

designed to accept additional water on a successional basis with the fishing lake and nature reserve being the first to flood followed by the recreational lakes. **Figure 8.13** shows the regulator gate after it was raised during flood conditions (2000) and the park flooded.

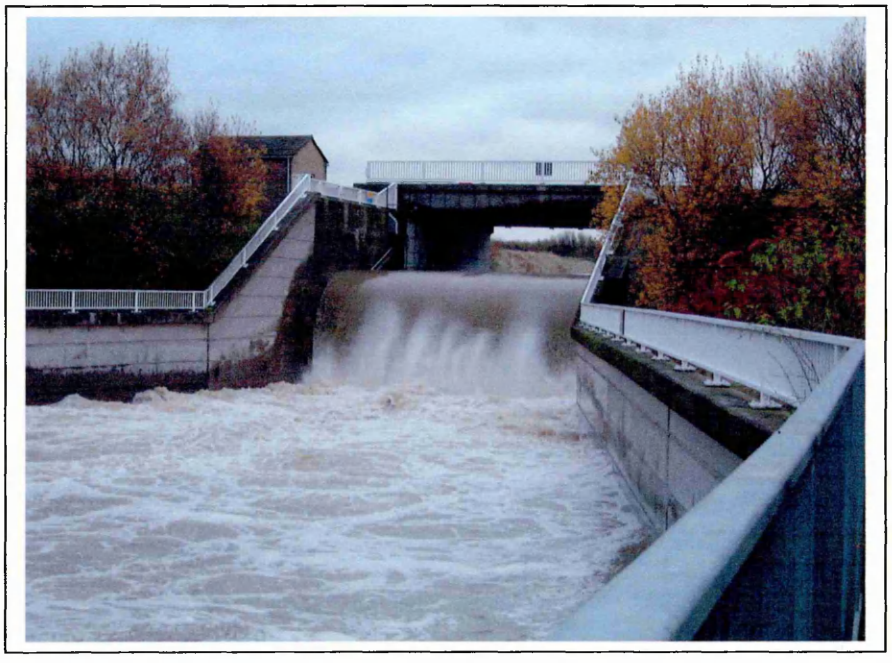


Figure 8.13: The regulator gate in operation at the park in the floods of autumn 2000. (Source: Gareth Horne).

A second objective was to create a wide variety of recreational pursuits, both water and land based. The third objective was to create several different habitats to be colonized by fauna and flora and as cover and feeding sites for migrating species to be enjoyed by the public using the park.

Following construction of the waterbodies water for the recreational lakes was pumped from the Moss Brook (a tributary of the River Rother) 2.5 kilometres away as the water in the Rother was, at that time, grossly polluted. 480,000 trees and shrubs were planted on the site and the only remaining building, Bedgreave Mill, was renovated to create the park offices and an interpretative centre that demonstrated how the once water-powered building would have milled corn for flour (Anon., online, undated [j]). A photograph of the mill has survived from about 1900 and is shown in **Figure 6.14**. A map of the finished project is shown in **Figure 8.15.**

Figure 8.14: Bedgreave Mill in 1900. (Source: Rother Valley Country Park).

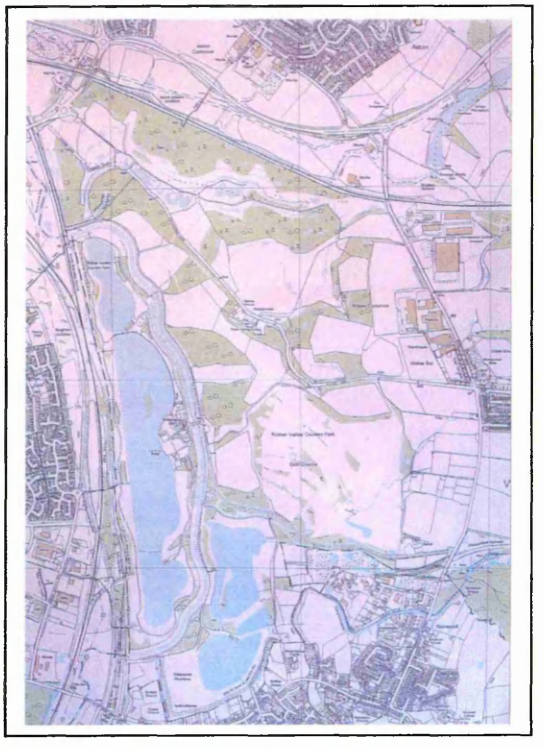


Figure 8.15: Map of the finished development. (Source: Rother Valley Country Park).

The park obtained significant funding from the Countryside Commission amounting to £1 million out of total costs of £4 million, and was officially opened by its Chairman in May, 1983. Visitor numbers have steadily increased over the years it has been open with average figures now being 750,000 people per year. Watersports have always been the central theme of the park but, as the site has matured, it has become more valuable for wildlife. Recreational facilities have also developed over the years with addition of a cable water ski system and a golf course. The current scheme for the park is shown in **Figure 8.16**.

Figure 8.16: **Schematic plan of the park's facilities.** (Source: Rother Valley Country Park).

An area adjacent to the park on land that was formerly the Brookhouse Colliery (seen in its heyday in **Figure 8.17**) was opencast mined following the closure of the deep mine pit. The site was now called Pit House West and the scale of the opencast is shown in **Figure 8.18**.

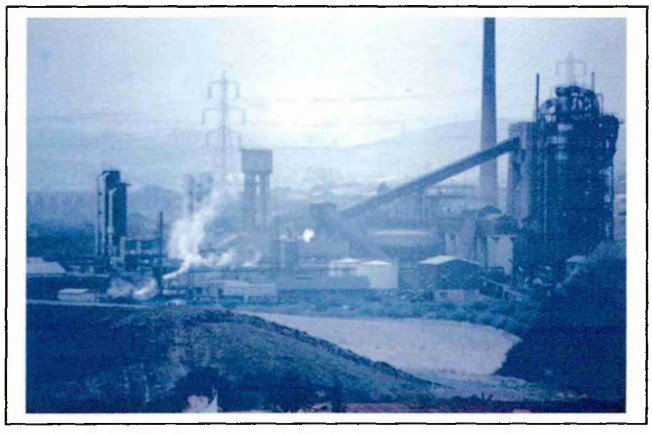


Figure 8.17: **The operational Brook-House Colliery c. 1975.** (Source: Rother Valley Country Park).

Figure 8.18: **Opencast mining at Pit House West.** (Source: Rother Valley Country Park).

The opencast site yielded 1.5 million tones of coal between 1989 and 1994. Tertiary landscaping took a further twelve months and has resulted in extensive planting of trees and shrubs over half the site and which forms a Core Area of the South Yorkshire Forest. Much of the surrounding land can be used for grazing but the area is currently being minimally managed for conservation and informal recreation whilst proposals for specific conservation and recreation features are being developed. As part of the scheme the culverted Pigeon Bridge Brook has now been restored to an open stream flowing through the site and is linked to a series of small ponds and wetlands (Anon., online, undated [j]).

8.2.1.3 Project funding.

The original project had approximate reclamation and development costs of £4 million. (More precise and detailed information is not available since the developer (British Coal Opencast absorbed reclamation costs into their opencast mining budget. It is therefore not possible to give an exact figure or value). The project was initiated under the former South Yorkshire County Council – devolved in 1986. It then passed to joint management by Rotherham MBC with Sheffield City Council and Derbyshire County Council. Both of the latter subsequently pulled out and withdrew their budget contributions. A breakdown of costs is shown in **Figure 8.19**.

Development Costs (Capital). (Project Date: 1970s/1980s, with extension in 1990s)
Sources of funding:
The Countryside Commission provided £1 million development funding (mainly for the Visitor Centre) together with a small amount of other support.
Yorkshire Water donated land together with a small amount of other funding.
British Coal provided development costs as part of opencast budget (the value of landscaping and tree planting >£3 million).
The Sports Council provided a grant for the Water-sports Centre together with some revenue for sports activities.
Local Authorities provided capital and revenue funding.
Pithouse West extension:
There was a projected £8 million for reclamation and development costs.
British Coal fund would contribute £1 million with the private sector providing the remainder.
Running Costs (Revenue).
£319,000 (staff costs)
£98,000 (premises costs)
£44,000 (transport costs)
Total Gross Costs (including all other support) = **£649,000**
Income against this = £142,000

Figure 8.19: **Breakdown of project costs for Rother Valley Country Park.**
(Source: Rother Valley Country Park).

The main drivers that provided the backdrop for the project are shown in **Figure 8.20**.

The main drivers that provided the backdrop for the project were:

* The 1960s desperate need for land for development to house Sheffield's rapidly expanding population. Rother Valley Country Park was developed as a 'green lung' and recreational resource for this expanding area.
* The National Coal Board's proposed opencast mining of the area with a funded end use that would reflect the desires for the park.
* Individual 'project champions' were not obvious as the project was pushed forward by officer involvement with political support.

Figure 8.20: Main drivers for the creation of Rother Valley Country Park.

8.2.2 Woodhouse Washlands Yorkshire Wildlife Trust Reserve, Sheffield.

8.2.2.1 General site description.

Grid Reference: SK 850440

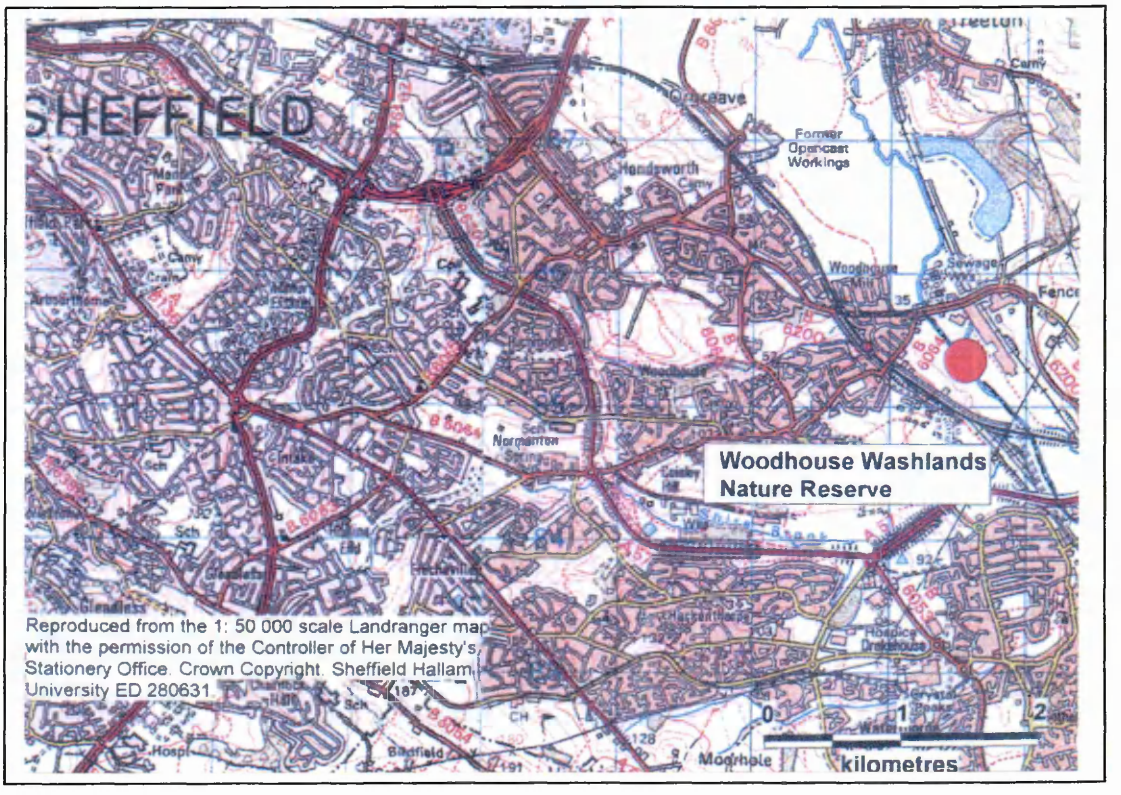


Figure 8.21: Location map of Woodhouse Washlands nature reserve.

Woodhouse Washlands is one of the last significant remnants of low-lying riverine wetlands that were formerly extensive along the Rother Valley. These were perhaps up to 30-40 km in length and possibly up to 2 km wide in a much wider valley bottom. Significant areas remained intact but increasingly degraded until the 1950s. Until the 1950s the Washlands was dominated by a multi-channelled, meandering river that flooded generally around 5-6 times per year. The locals described it as *'The Swamps'* and remember how it *'were full of newts and snakes'* (Rotherham and Cartwright, 2000 [b]). The Washlands cover about 66 hectares and are situated at Woodhouse Mill in Sheffield at its border with Rotherham. The River Rother itself forms the administrative boundary. **Figure 8.22** shows the reserve boundary and **Figure 8.23** is a view of the River Rother looking into the reserve.

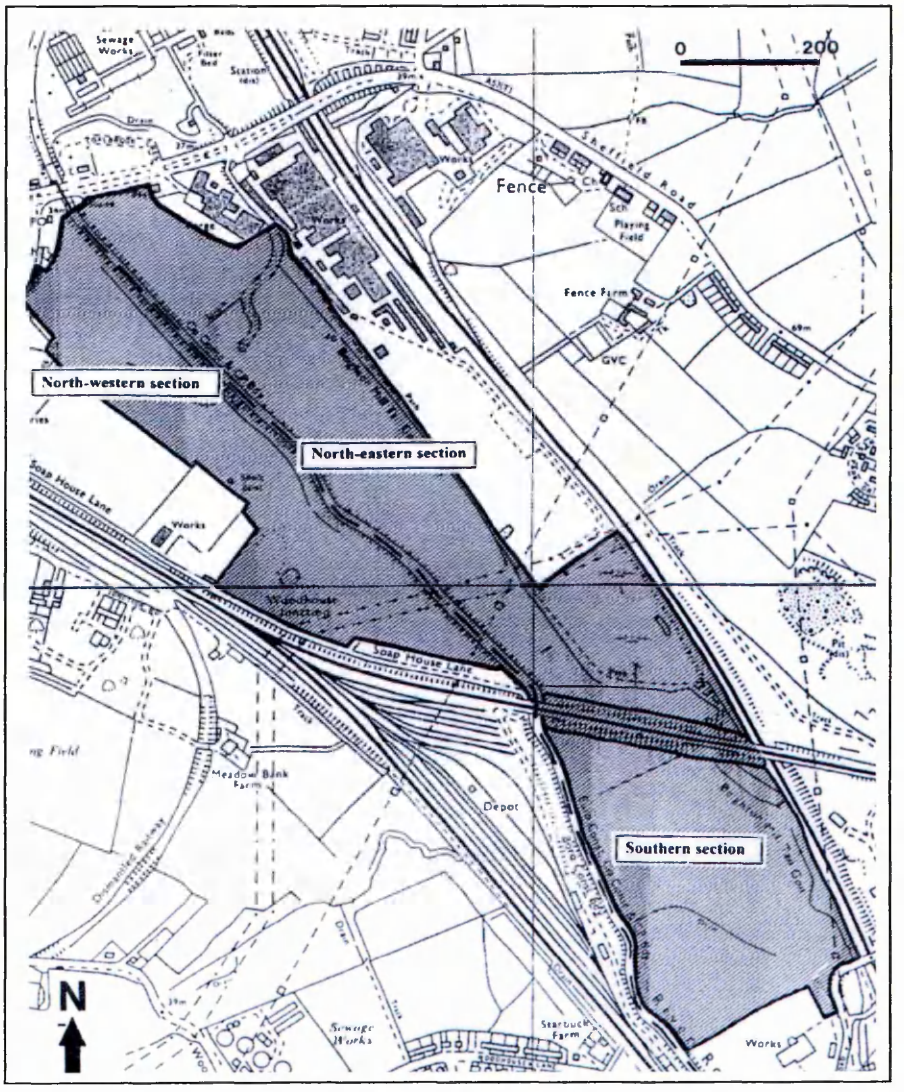


Figure 8.22: **Woodhouse Washlands reserve boundary.** (Source: Anon., 1995b).

Figure 8.23: **View of the River Rother looking into Woodhouse Washlands nature reserve.** (Source: Woodhouse Washlands Management Committee [WWMC]).

Since the early 1960s, when the river was canalised, the Washlands, owned by the Environment Agency, have been part of the strategic flood control system for the valley with a prime aim for the site as flood water storage function. A regulator gate, similar to that at Rother Valley Country Park, is situated at the main A57 roadway and can be raised to store flood water on the reserve when necessary. **Figures 8.24** and **8.25** are views of the reserve after the gate had been raised in autumn 2000.

Figure 8.24: View of the reserve after flooding in autumn 2000. (Source: WWMC).

Figure 8.25: View of the reserve after flooding in autumn 2000. (Source: WWMC).

The Washlands area is the only landscape of its type still found in the Sheffield district. It is also an important conservation node in the major green corridor and bird migration route of the Rother Valley.

8.2.2.2 Site history and development.

Except to a few local birdwatchers, the significance of the site was only fully recognised in the early 1990s when the *Sheffield Nature Conservation Strategy* (Bownes *et al.*, 1991) and The *River Rother Wildlife Strategy* (1994) led to searches for potential sites for conservation and management. Recognition as an important site led to its designation as a *Site of Scientific Interest* within the *Sheffield Nature Conservation Strategy*, and the equivalent in the adjacent Rotherham Metropolitan Borough Council.

Although flooding of the Washlands is now a relatively rare occurrence, some evidence remains of the ponds, dykes, wet grassland and marsh that would have been associated with the intermittently flooded land. Because much of the site can still be wet, management of the water table, of existing wet environments, and the creation of new ones, are still vital management issues (Rotherham, 2001).

The major wet feature of the reserve that is often ignored is the river itself. The water quality has dramatically improved over the last decade which has led to its greater importance for wildlife. Its importance lies in its function as a conduit for species movement; in its value as habitat via the water body and the river bed; and as habitat provided for a diversity of species on the river banks (Rotherham, 2001). The main vegetation types on the Washland areas are shown in **Figure 8.26** and an example of the wet grassland present is shown in **Figure 8.27** overleaf.

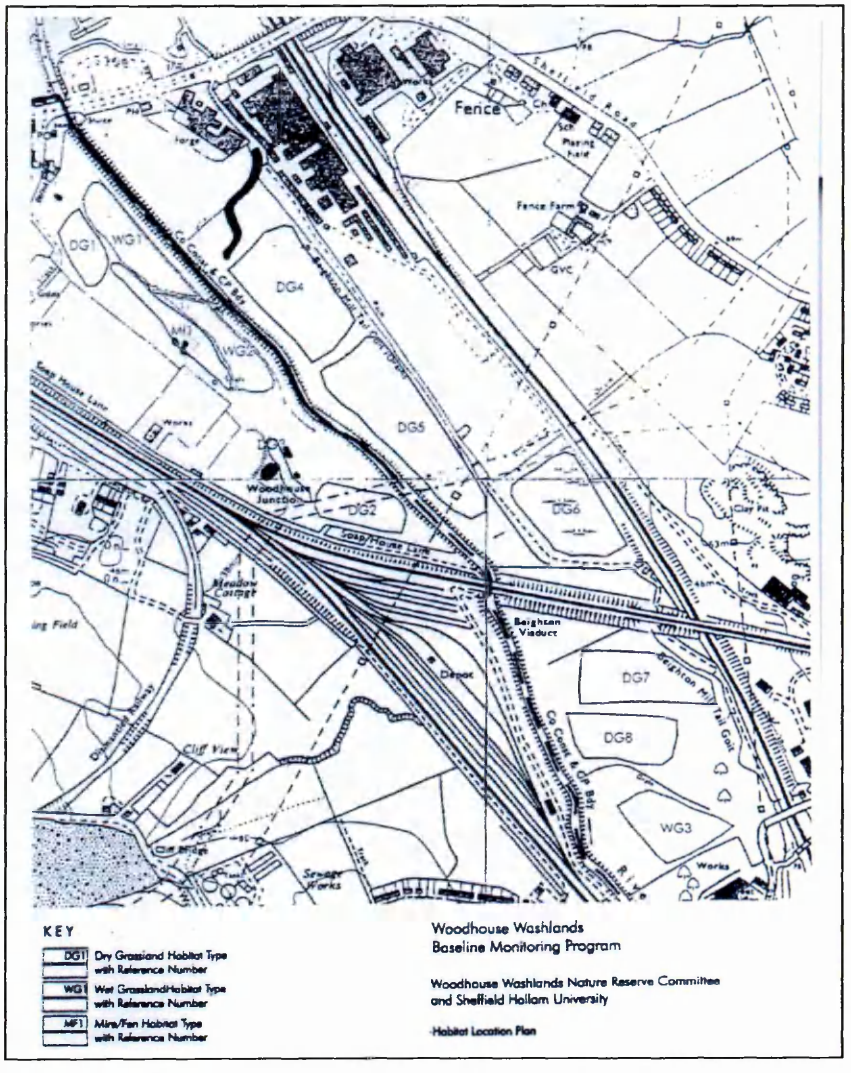


Figure 8.26: The main vegetation types on the Woodhouse Washlands reserve.
(Source: Rotherham, 2001).

Figure 8.27: An example of the wet grassland present on the Woodhouse Washlands reserve.
(Source: Woodhouse Washlands nature reserve management committee).

Two developments were critical in the conservation of this 'very special ordinary site'. Firstly, the *South Yorkshire Forest Partnership* was established and was able to target funds and strategic recognition towards the area. Secondly, the Countryside Stewardship Grant Aid Scheme came on-line in time to support much of the necessary work. These two effectively oiled the wheels of action. [*Woodhouse Washlands Proposed Nature Reserve – Feasibility Study* (1994); *Woodhouse Washlands Management Plan* (1995)].

In the socio-economic panorama of this location, in the shadow of the former Orgreave Colliery, perhaps the main achievement has been the actual acquisition, establishment and initial development of the nature reserve. This has been achieved in the context of very minimal base-line resources and a huge effort from local people which should not be understated. The identification and establishment of the nature reserve was directly linked to the process of development of the *Sheffield Nature Conservation Strategy* (Bownes *et al.*, 1991), and also of the *River Rother Wildlife Strategy* (Anon., 1994c). It forms a key component of the outcomes of both these documents and links strategically to other related sites in the region. The reserve was formally established in 1995 and has recently been designated as a *Local Nature Reserve* (Rotherham and Cartwright, 2000). The reserve's long-term management aims are shown in **Figure 8.28**.

Woodhouse Washlands management aims are to:

* ***Reverse the decline of the site's wildlife value; conserving and enhancing good features and creating new ones to attract more wildlife species. (Some of these may have been present many years ago, before the original wetlands were largely destroyed).***
* ***Use the site for the benefit and enjoyment of the public (especially local people) - achieved by developing educational and interpretation facilities, improving access with the provision of footpaths, car parking, hides, signs and a visitor centre.***
* ***Improve the landscape and enhance the site by the creation of a range of habitat-types typical of a 'washlands'.***

Figure 8.28: **Management aims for Woodhouse Washlands nature reserve.**
(Source: Woodhouse Washlands Management Committee)

The requirements as suggested in the *Feasibility Study* are shown in **Figure 8.29** and **Figure 8.30** (overleaf) identifies proposals for possible future management and development.

Requirements to achieve the long-term aims include:

* *Raising the water levels on parts of the site to increase the marsh areas, and by provision of 'scrapes' on other areas.*
* *Increasing the number of ponds – some for educational use and others as sanctuary areas for bird life.*
* *Introducing a sensitive grazing regime backed by the Countryside Stewardship scheme.*
* *Some planting of berry-bearing shrubs and nectar-rich flowers to screen parts of the site and provide more habitat-type for small birds, small mammals and insects.*
* *Producing leaflets, displays and other interpretative material for use on the site and for work with the local community including schools.*

Figure 8.29: **Requirements to achieve the long-term aims of Woodhouse Washlands nature reserve.** (Source: Anon., 1995b).

The work has been a mixture of appropriate 'habitat' creation and restoration of traditional farming management over this seventy hectare site.

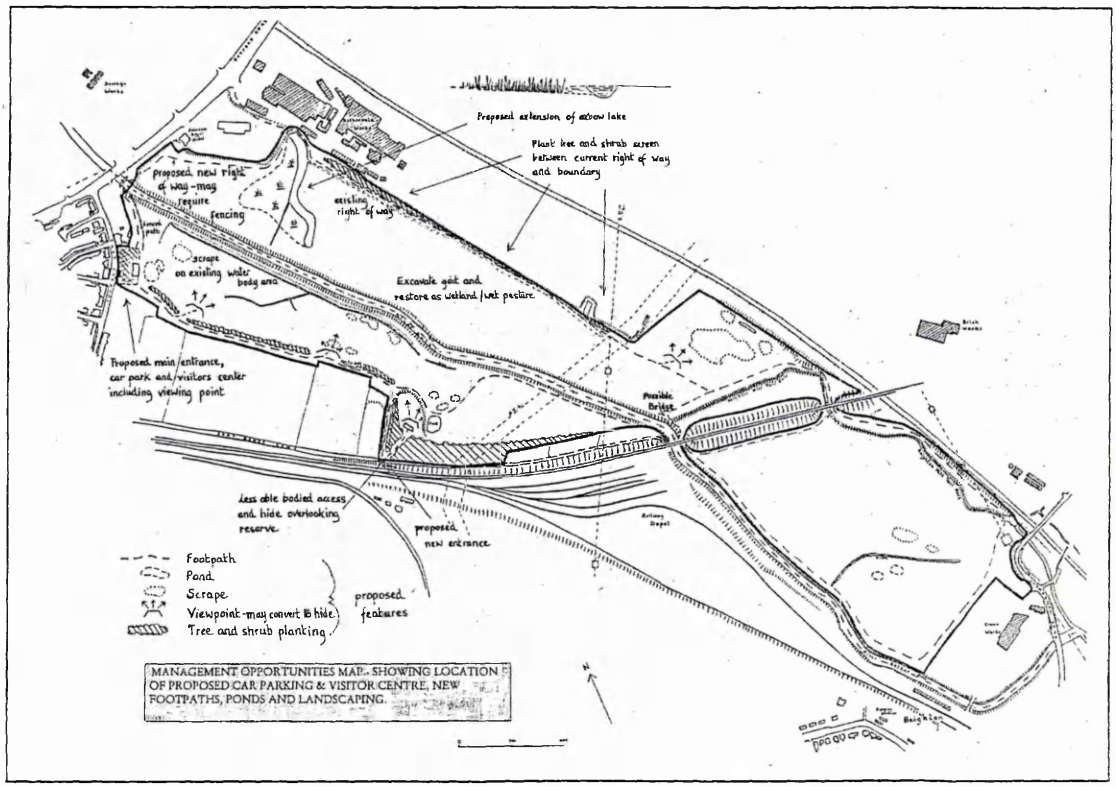


Figure 8.30: **Proposals for possible future management and development at Woodhouse Washlands nature reserve.** (Source: Anon., 1995b).

The management committee of the reserve is responsible to a tri-partite steering group from Sheffield City Council, the Yorkshire Wildlife and Sheffield Wildlife Action Partnership (SWAP). SWAP is the lead agency and its aims are to set up new nature reserves and community wildlife areas which everyone can visit and enjoy. Through this they hope to promote ownership and responsibility for their own 'patch'. This has been achieved at Woodhouse Washlands with a great deal of success.

8.2.2.3 Project funding.

A breakdown of costs is shown in **Figure 8.31**.

Development Costs (Capital) (Project Date: 1990s).
Project set-up costs including research and development were approximately £10,000 from the Countryside Commission and South Yorkshire Forest Partnership.
Landscaping works associated with the Reserve but as part of Planning Gain from an adjacent housing development were valued at *c.* £25,000
Capital expenditure on agricultural management (stock-proof fencing *etc.*) c. £10,000
Running Costs (Revenue).
Staff and revenue cost *c.* £17,000 per annum. (For each of the first six years).
Sources of funding:
Countryside Commission (grant to Local Authority).
Countryside Commission (now DEFRA) (Countryside Stewardship Grants).
South Yorkshire Forest Partnership (grants for research and development and then implementation).
Environment Agency (support and grants).
Grazing income (licensed grazier).
Private sector sponsorship and competitive awards has been provided for educational projects *etc.*

Figure 8.31: Breakdown of project costs for Woodhouse Washlands.

The main drivers for the creation of the project are shown in **Figure 8.32**.

The main drivers for the creation of the project were:

* The inclusion of the site as a valuable series of habitat types and highlighted as having conservation and recreational value in the *Sheffield Nature Conservation Strategy* (Bownes *et al.*, 1991) and The *River Rother Wildlife Strategy* (1994).
* Designation as a *Site of Scientific Interest* within the *Sheffield Nature Conservation Strategy*, and the equivalent in the adjacent Rotherham Metropolitan Borough Council.
* The creation of the *South Yorkshire Forest Partnership* was established enabled to funds to be targeted at the site and strategic recognition be given to the area.
* The Countryside Stewardship Grant Aid Scheme came on-line in time to support much of the necessary work.
* The above two factors effectively oiled the wheels of action. [*Woodhouse Washlands Proposed Nature Reserve – Feasibility Study* (1994); *Woodhouse Washlands Management Plan* (1995)].
* In terms of 'project champions' several people have been involved but Ian Rotherham, in his role as a local authority officer, was the one person critical to the continuing movement of achieving the above and in gathering together an interested group of people to develop the reserve's potential as the Woodhouse Washlands nature reserve management committee. This is now chaired by Christine Handley.

Figure 8.32: Main drivers for the creation of the Woodhouse Washlands nature reserve.

8.2.3 Blackburn Meadows nature reserve (Sheffield City Council with the Blackburn Meadows Trust - now Sheffield Wildlife Trust), Sheffield.

8.2.3.1 General site description.

Grid Reference: SK 410 920

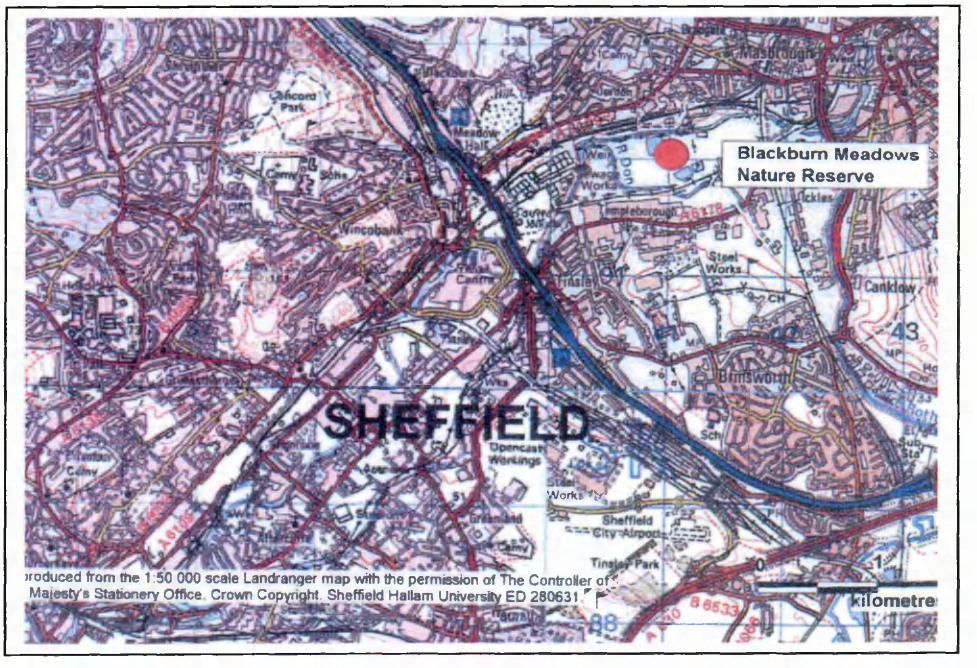


Figure 8.33: Location map of Blackburn Meadows nature reserve.

Blackburn Meadows Nature Reserve lies on the outskirts of the Sheffield at its boundary with Rotherham, sandwiched between the River Don and the Sheffield to Keadby Canal. It occupies approximately 17 hectares of the former Tinsley Sewage Farm; approximately 6km northeast of Sheffield City Centre and 2km west of Rotherham Town Centre. **Figure 8.34** is an aerial photograph of the site prior to development.

Figure 8.34: Aerial photograph of Blackburn Meadows nature reserve prior to development. (Source: Author).

8.2.3.2 Site history and development.

The scheme is a flagship project for Sheffield City Council in terms of its environmental / leisure significance and its potential as an attractive setting to encourage industrial re growth. In this context it is also recognised by Rotherham MBC as a 'green' backcloth and available leisure facility for its adjacent Templeborough Regeneration Project (Cartwright, 1986). Lying within five minutes drive time of one of Europe's largest shopping and leisure facilities (Meadowhall Shopping Centre), and with the M1 motorway so close, the reserve is accessible to over four million people living within forty-five minutes drive time. In the *South Yorkshire Forest* initiative Blackburn Meadows Nature Reserve is classified as a key strategic site. It acts as a lynch-pin between the Don and Rother Valleys, linking opportunities along the canal and river corridors between Sheffield and Rotherham, and southwards through the Rother Valley Washlands to Rother Valley Country Park, and beyond into North Derbyshire (Cartwright, 1986).

Early land use was agricultural as wet pasture with the land subject to flooding. Little further development took place until around 1958. At this time the site became an active part of the Sheffield Corporation Sewage Works that had developed from the late 1800s and had already affected and absorbed much of the surrounding flood plain adjacent to the Don. In the early stages of these developments the site was subject to sand and gravel extraction which subsequently formed the basis of large sludge settling lagoons associated with the Blackburn Meadows Sewage Treatment Works to the west of the site which takes the bulk of Sheffield's sewage – both domestic and industrial. Lagooning was a process used as a tertiary treatment to up-grade the quality of final effluent by further removing suspended matter through sedimentation, requiring large areas to work effectively. The sludge may be in slurry form as pressed 'cake', or as incinerated ash from the sewage treatment works own operations. However, the site was also licensed to accept inert fill from construction and demolition wastes and small quantities of hazardous materials (Cartwright, 1986).

Around 1980 Sheffield Bird Study Group (SBSG), working with the Yorkshire Wildlife Trust (then Yorkshire Naturalists' Trust), attempted to persuade the Yorkshire Water Authority to declare a small section in the south east of the area as a nature reserve that SBSG would manage. This was in particular recognition of the fact that this area was being used as a nesting site for Little Ringed Plover (*Charadrius dubius*) - then a nationally rare breeding bird (Cartwright, 1986). The author was an instrumental part of the group proposing this project. **Figures 8.35** and **8.36** show views of the way one of the lagoons had developed through being abandoned and places the site in its industrial surroundings.

Figure 8.35: Existing lagoon at Blackburn Meadows in its industrial setting. (Source: Author).

Figure 8.36: Existing lagoon at Blackburn Meadows looking west towards Sheffield City Centre. (Source: Ric Bingham).

Although consent was given for this the Water Authority added a caveat that at any time they may require the land for emergency tipping purposes. This in effect meant that the proposal was not viable for the groups involved and the scheme was abandoned. However, it was not forgotten, and in the mid 1980s a group of Sheffield City Council officers, including the author, was formulating a Local Plan for the Lower Don Valley area of the City. This included a survey and evaluation of ecological sites. The tipping area of the sewage treatment works was identified and highlighted as of particular value for both its ecology and its potential as an educational and leisure resource.

Since this time, initially under the coordination of the author, the site has gone on to become a major urban, wetland nature reserve and educational resource for the region. The steering group responsible for developing the project agreed the main aims of the reserve (**Figure 8.37**).

There are six main aims for the reserve:-

* ***To provide a series of diverse wetland habitats as sanctuary for wildlife in an area limited in such resources.***
* ***To provide exceptional facilities for environmental education in an area which is devoid of such resources and which lies in a belt of social deprivation.***
* ***To provide quality facilities that can be used by all sectors of the community including people with disabilities.***
* ***To provide informal recreation in a 'countryside' setting for the local community, the local workforce, visitors to the area and specialist interest groups.***
* ***To provide a base for scientific research and study.***
* ***To provide a 'flagship' project within the green frame of the economic and social regeneration of the former industrial heart of the area.***

Figure 8.37: **Main aims for the Blackburn Meadows nature reserve project.** (Source: Author).

In conjunction with a main thrust towards environmental education the reserve steering group were anxious to promote the site as a centre for environmental art that would provide foci for interpretation and education examples of these are shown in **Figures 8.38** and **8.39**.

Figure 8.38: **The Heron Gate - future main access point at Blackburn Meadows.** (Source: Author).

Figure 8.39: **Dragonfly and damselfly sculptures in the main lake at Blackburn Meadows.** (Source: Author).

The feasibility of the project required at the outset a major site assessment and evaluation – including for serious land stability hazards and heavy metal contamination. Following this initial survey development to create a diversity of wetland habitats with visitor facilities was commenced. This also included making the site safe. Due to the site conditions this involved utilising innovative engineering techniques. **Figure 8.40** overleaf is the initial schematic design for the reserve of which the areas marked 'Lake' and 'Wader flash' were initially created with associated footpaths, birdwatching hides and planting.

Figure 8.40: **Original schematic plan of proposed developments.** (Source: Sheffield City Council).

Figure 8.41 overleaf is a second phase proposal (not yet implemented).

Figure 8.41: Current schematic plan proposals (not yet implemented). (Source: Sheffield City Council).

Figure 8.42 shows a view of the created main lake with 'dry stone wall' constructed birdwatching hide and the derelict cooling towers in the distance adjacent to junction 24 of the M1 motorway. **Figure 8.43** shows a mature lagoon with the Magna discovery centre in the background.

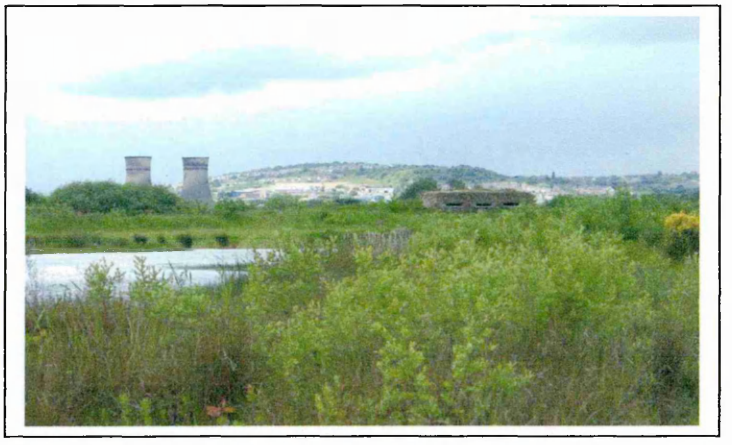


Figure 8.42: **Blackburn Meadows main lake habitat creation.** (Source: Ric Bingham).

Figure 8.43: **Mature lagoon at Blackburn Meadows and 'Magna'.** (Source: Ric Bingham).

The site management has been overseen and implemented by Sheffield City Council, and the visitor management and educational work done by the Blackburn Meadows Trust, and now with the Sheffield Wildlife Trust. By 2003 the project will be delivering to over 150 educational group visits per year.

8.1.3.3 Project funding.

A breakdown of costs is shown in **Figure 8.44** overleaf

Development Costs (Capital) (Project Date: 1980s/1990s).
British Coal Opencast (ecological rescue of material from the Tinsley Park Opencast scheme)
Section 106 Planning Agreement: £70,000
Derelict Land Grant (site investigation): £42,000
Derelict Land Grant, Urban Programme, European Regional Development Fund (site preparation): £550,000
Methane protection measures for the adjacent development site: £250,000
Support in-kind from Sheffield City Council (project team salaries *etc.*): unquantified.
[Phase 2 bid for Objective One Funding: £1.8 million].
Running Costs (Revenue).
c. £30,000 *per annum* up to 1999
From July 2000:
Education Staff costs:£46,000
Contracts: £2,000
Rental: £3,000
Project costs: £4,000
Volunteer costs: £1,500
Small projects and Maintenance budget: £5,000 (Sheffield City Council and Countryside Agency).

Figure 8.44: **Breakdown of costs for Blackburn Meadows nature reserve.** (Source: Sheffield City Council).

The main drivers for the creation of the reserve are shown in **Figure 8.45**.

The main drivers for the creation of the reserve were:

* Sheffield Bird Study Group's (SBSG) interest in a part of the site as a nature reserve that SBSG would manage in recognition of the fact that this area was being used as a nesting site for Little Ringed Plover (*Charadrius dubius*) - then a nationally rare breeding bird.
* For various reasons this project was not viable for the groups involved and the scheme was abandoned. However, it was not forgotten, and in the mid 1980s a group of Sheffield City Council officers, including the author, promoted a project at the site as part of the formulation of a Local Plan for the Lower Don Valley area of the City.
* This was accepted as potentially being a flagship project for Sheffield City Council in terms of its environmental / leisure significance and its potential as an attractive setting to encourage industrial re growth. In this context it was also recognised by Rotherham MBC as having the potential to be a 'green' backcloth and available leisure facility for its adjacent Templeborough Regeneration Project.
* In the *South Yorkshire Forest* initiative the project was classified as a potential key strategic site.
* Water Authorities throughout the UK were being privatised and the company needed to enhance its 'green' image. There was significant public campaigning from various voluntary sector organisations and from local communities for the adjacent sewage treatment works to be enhanced in environmental terms.
* In terms of a 'project champion' several people had been involved in campaigning for a nature reserve at the site over a long period of time. The author was initially involved in the site through his voluntary work on the Sheffield Bird Study Group's nature reserves committee. He also initiated initial ecological surveys of the site and later, in his role as a local authority officer, became the project coordinator of the habitat creation scheme at the site. He later had active involvement as Chair of the Blackburn Meadows Trust which was responsible for visitor management and the education programme at the site until these roles were passed on to the Sheffield Wildlife Trust.

Figure 8.45: Main drivers for the creation of the Blackburn Meadows nature reserve.

8.2.4 Old Moor Wetland Centre (now RSPB), Barnsley.

8.2.4.1 General site description.

Grid Reference: SK 423 025

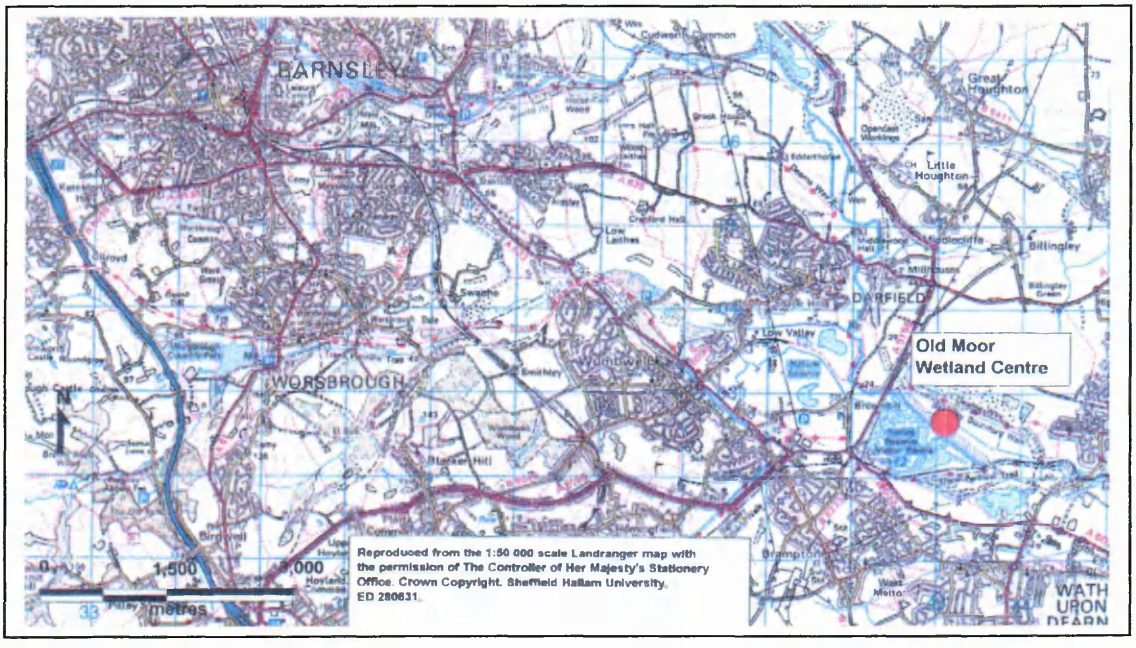


Figure 8.46: Location map of Old Moor Wetland Centre.

The Old Moor Wetland Centre lies within a largely rural former coalfield and is a large site of 104 hectares located in the heart of this former heavy industry, mostly associated with coal mining, coal storage and processing, and major transportation networks. The site is set within a varied and striking landscape surrounded by agricultural land but also within a complex of urban sprawl. Much of the area is, or was, wet grassland and the site was historically a part of the once extensive washlands of the Dearne Valley, and in recent decades had become increasingly liable to mining subsidence flooding creating '*flashes*' and '*ings*' which is a Yorkshire word meaning wet meadow. Both are important for species in decline in the UK.

As the economy of the area adjusts to the decline of the coal industry, the need for environmental regeneration of the Dearne Valley's natural heritage is an acknowledged priority. Some degree of environmental enhancement has taken place since the 1990s. In particular, coal waste tips (the characteristic '*slag heaps*') have been capped and landscaped. During 1991 – 1995 Barnsley and Rotherham Councils collaborated to invest heavily in the area and obtained major funding from the EU RECHAR fund and UK government aid. This has led to new road infrastructure, urban renewal schemes, improved public transport and the enlargement of the

former Wath Ings nature reserve to create a new 104 hectare site which has become the Old Moor Wetland Centre (RSPB, 2001).

8.2.4.2 Site history and development.

The first very modest nature reserves were established on parts of the site in the 1970s. With few resources and no facilities, these were wonderful sites for rare birds but only for the enthusiastic and hardened birdwatcher. Local birdwatchers and the Yorkshire Wildlife Trust were largely responsible for maintaining the interest and developing the potential in these vital early days.

Building on this unlikely foundation of largely fortunate accident, benign neglect and dedicated perseverance, the centre is now part of a significant package of initiatives to improve both the economy and the environment of the region. It is a largely artificial wetland created following the restoration of the now defunct Wath Manvers colliery. It comprises a mix of wetland habitats including lowland wet grassland, a wader scrape, wildfowl mere and a 20 hectare reed bed which is still in an early developmental stage. The site was originally created to a design provided by the Wildfowl and Wetlands Trust with a view to that organisation taking on the centre's management. This has not happened and Barnsley MBC has been running the reserve and its visitor centre (RSPB, 2001). Opened in 1999, the site now has substantial and state-of-the-art facilities and is an environmental flagship for regeneration in the area. Initial target visitor numbers were around 90,000 per year and in the early stages the project generated around six new permanent posts, and secured two others, along with between thirty-five and fifty temporary posts over the first two years of construction.

Figure 8.47 is an aerial photograph of the site during construction of its diverse wetland habitats and **Figure 8.48** is a schematic diagram of the desired features of the project.

Figure 8.47: Aerial photograph of Old Moor Wetland Centre during construction. (Source: Barnsley MBC).

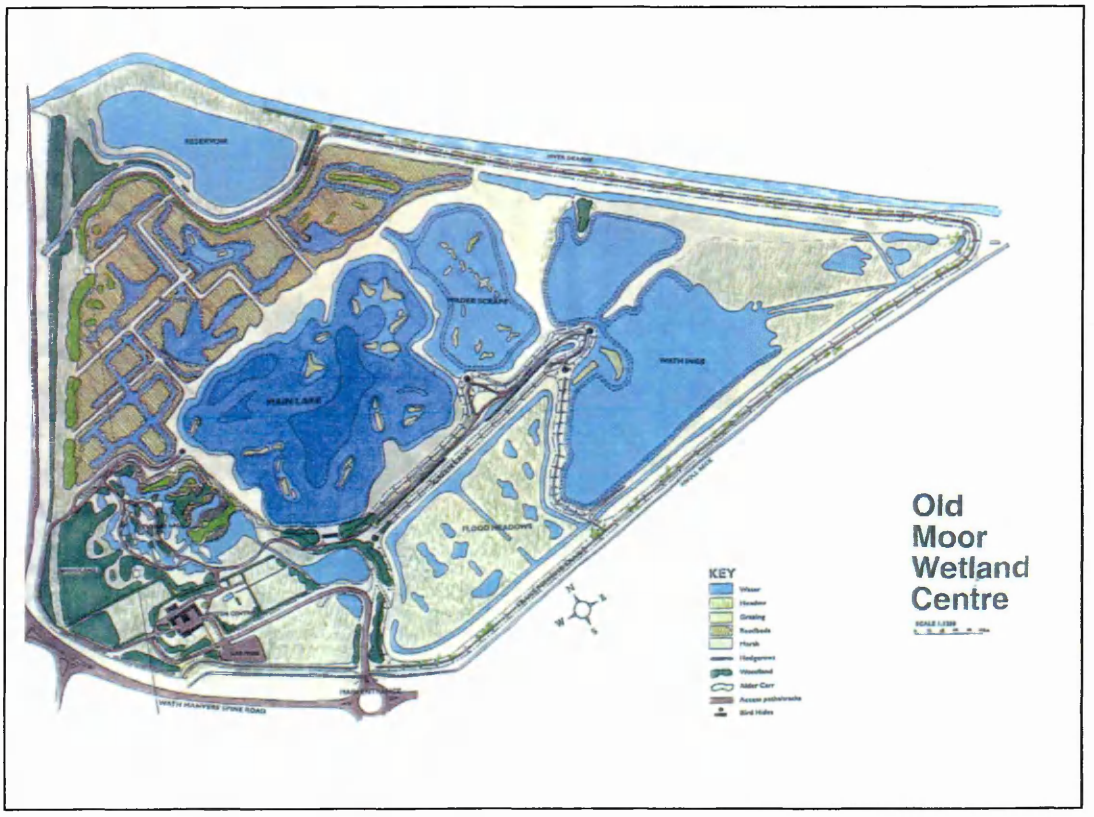


Figure 8.48: Schematic diagram of the desired state of the Old Moor Wetland Centre project. (Source: Barnsley MBC).

Figure 8.49 is a view of the constructed main lake and **Figure 8.50** shows one of the interconnecting drainage dykes.

Figure 8.49: **View of the constructed main lake at Old Moor Wetlands Centre.** (Source: Author).

Figure 8.50: **Drainage dyke at Old Moor Wetland Centre.** (Source: Author).

Having always wanted to hand over management to a specialist conservation body Barnsley council has successfully negotiated with the Royal Society for the Protection of Birds (RSPB) to take on this role. However the RSPB were not content to just manage the Old Moor site but see it much more as the lynch pin of a bigger complex of sites along the Dearne Valley.

Barnsley MBC produced a five-year management plan for the Old Moor site in 1999. The plan had been well-researched and provided a valuable source of base data information but had significant shortfalls as shown in **Figure 8.51**.

1999 management plan shortfalls:

* It is solely for the Old Moor reserve and does not include the wider vision and opportunities provided by links to other Dearne Valley existing or potential wetland sites.
* It is habitat-based and does not integrate plans for visitors, education, interpretation and community involvement.
* It uses the full Nature Conservancy Council management planning format which is not user friendly. Thus it was produced as a technical, non-accessible document which becomes difficult to translate into action on the ground.

Figure 8.51: Shortfalls of the 1999 Old Moor nature reserve management plan. (RSPB, 2001).

In order to address these issues the RSPB will write a new management plan for the entire Dearne Valley wetlands and treat them as one site (RSPB, 2001). The project will be achieved by leasing significant amounts of Environment Agency owned washlands and collaboration with other organisations to sympathetically manage these sites as a series of wetland nodes in the river corridor. Chris Firth the Environment Agency' Fisheries Officer for the region, in a personal communication (December, 2002) described this collaborative venture as a "*necklace of wetland jewels along the valley*". It is hoped the project will deliver the following measurable targets:

* 40 hectares of reed bed habitat (3.3% of the UK Biodiversity Action plan target)
* 200 hectares of lowland wet grassland (2% of the UK Biodiversity Action plan target

Restoring appropriate management should enable typical species such as Lapwing, redshank and snipe to triple their breeding numbers and for otters and water vole to return relatively easily. All are targets of conservation action at national and local level through the UK and Local Biodiversity Action Planning process.

The RSPBs vision/aims for this complex of sites are shown in **Figure 8.52**.

Dearne Valley wetland vision:

Environmental

* ***A landscape rich in wildlife for people to enjoy.***
* ***Creation of 400 hectares of new Community Wetland.***
* ***A sustainable approach to land use planning and flood plain management.***
* ***Pioneering approaches to sustainable living, working, transport and building design.***

Social

* ***Improved quality of life for local people.***
* ***Local people actively managing their environment.***
* ***New learning opportunities for all age groups.***
* ***Improved access and enjoyment of a quality environment and its wildlife.***

Economic

* ***A quality environment attracting new businesses.***
* ***Diverse training and development opportunities.***
* ***An invigorated visitor economy.***
* ***New business opportunities linked to environmental management.***

Figure 8.52: The RSPBs vision for the Dearne Valley wetlands. (Source RSPB, 2001).

Within this vision Old Moor Wetland Centre is seen as the major visitor attraction and will act as the hub for all the other projected sites within the valley. Indications suggest a large number of people will be attracted to the sites and this will require significant upgrading of the visitor facilities, provision of interpretation and an education service. Further refurbishment of the visitor centre is estimated at £250,000 and other buildings development will provide storage, accommodation for residential volunteers and trainees, educational facilities, small-scale conference facilities, a specialist childcare centre, a new regional office for the RSPB, office space for environmental organisations and a youth hostel or Field Studies centre.

Figure 8.53 shows the visitor centre originally restored from derelict farm buildings.

Figure 8.53: Visitor centre at Old Moor Wetland Centre in converted farm buildings. (Source: Author).

8.2.4.3 Project funding.

A breakdown of initial costs to develop the reserve is shown in **Figure 8.54** overleaf.

Development Costs (Capital) (Project Date: 1990s).

1. Environmental Improvements under RECHAR Measure 2 1996.

Sources of funding:

City Challenge - £189,000.

Derelict Land Grant - £182,000.

In Kind support - £40,000.

Barnsley MBC - £18,000.

Countryside Commission - £18,000.

European Regional Development Fund - £373,000.

TOTAL: £820,297.

2. Visitor Centre under RECHAR Measure 4.

Sources of funding:

City Challenge - £153,000.

European Regional Development Fund - £102,000

TOTAL: £255,000.

Running Costs (Revenue).

£45,000 ***per annum*** including staff. (Estimated budget).

RSPB proposed developments [Old Moor] (Capital).

Buildings refurbishment - £503,680

Land set-up works - £35,000

Visitor infrastructure - £48,000

TOTAL: £586,680

RSPB staffing costs [Old Moor] (Revenue).

Project Manager (3 year initial contract) - £87,869

Project administrative support (3 year estimate) - £49,764

TOTAL (for 3 years): £137,633

Figure 8.54: Breakdown of costs for Old Moor Wetland Centre.
(Source: Barnsley MBC and RSPB, 2001).

The main drivers for the creation of the reserve are shown in **Figure 8.55**.

The main drivers for the creation of the reserve were:

* Modest nature reserves were established on parts of the site in the 1970s but with few resources and no facilities. These were wonderful sites for rare birds but only for enthusiastic birdwatchers. But they did form a nucleus of nature conservation that would attract further investment when the right set of circumstances was in place.
* Following the decimation of the coal mining industry which predominated in the valley there was a push to transform the area in landscape and funding terms to provide a sound basis for social and economic regeneration. The reserve and its centre are now part of a significant package of initiatives to improve both the economy and the environment of the region.
* Barnsley council has successfully negotiated with the Royal Society for the Protection of Birds (RSPB) to take on this role. This opens a significant extra funding opportunities. The RSPB are not content to just manage the Old Moor site but see it much more as the lynch pin of a bigger complex of sites along the Dearne Valley.
* There has been a significant culture change in the RSPB in respect of site acquisition moving from a policy of sites of significant conservation value to now include sites that have important community, education, tourism and recreational value.
* There was no prominent 'project champion' identified in the research.

Figure 8.55: Main drivers for the creation of the Old Moor nature reserve.

8.2.5 Potteric Carr Yorkshire Wildlife Trust Reserve, Doncaster.

8.2.5.1 General site description.

Grid Reference: SE 595 008

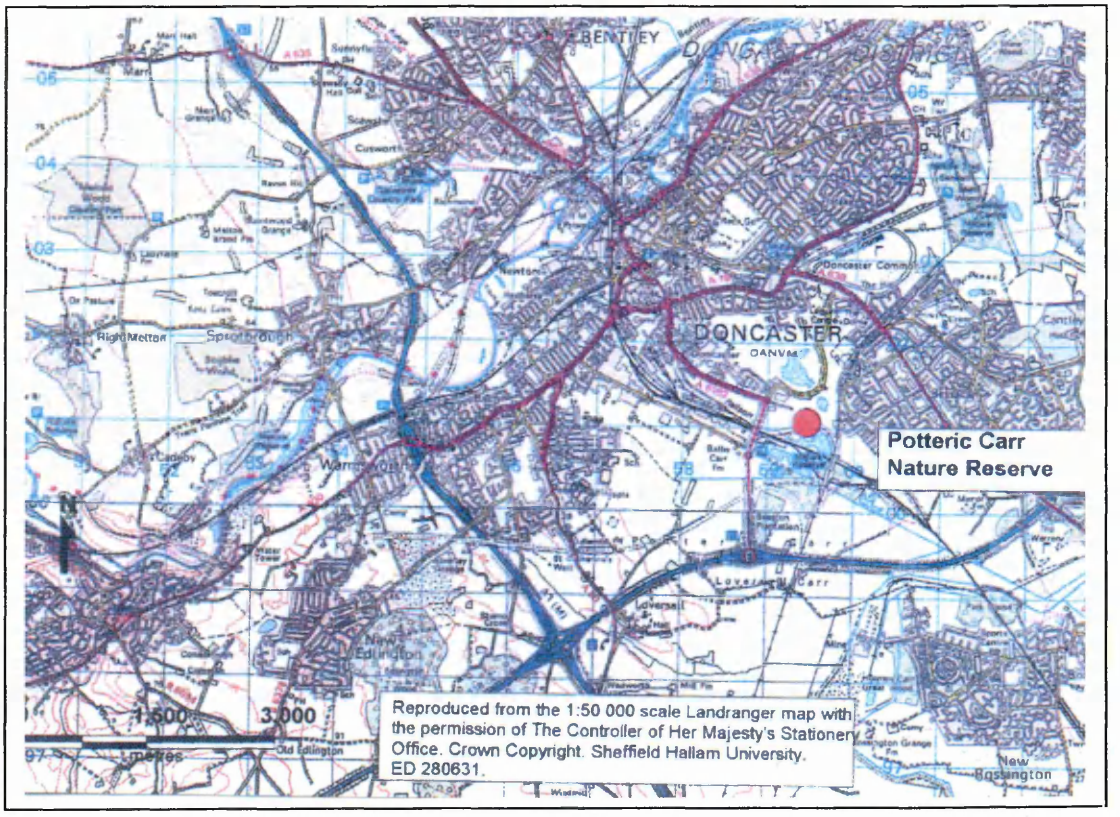


Figure 8.56: Location map of Potteric Carr nature reserve.

Potteric Carr Nature Reserve is situated between the M18 motorway, and the development areas of Catesby and Lakeside on the southern edge of Doncaster. Located just off the main link road to the M18, the reserve is only three kilometres from Doncaster town centre.

8.2.5.2 Site history and development.

Formerly a natural wetland, the reserve lies at the centre of a shallow basin not more than 10 metres above sea level but the area has seen successive drainage regimes implemented to remove excess water, over a period of hundreds of years. This has caused a resultant loss of wetland habitat. The construction of several main and branch line railways across the pre-reserve site made the area difficult for commercial development. Building on the site has therefore been restricted to construction associated with railways and drainage works. **Figure 8.57** shows part of the reserve in the context of its proximity to the railway system.

Figure 8.57: **Potteric Carr nature reserve in the context of its proximity to the railway system.** (Source: Yorkshire Wildlife Trust).

As a result of comparatively recent deep vein coal mining in the area, subsidence of the land has occurred, and in an ironic turn of fate, the subsidence has resulted in the creation of large areas of wetland and pools. In turn this has encouraged the return of wetland species, many of which appear to have survived in small communities in and around the numerous drains crossing the reserve site.

The re-occurrence of the wetland habitat and associated species did not go un-noticed, and through the enthusiasm and work of local people, the importance of Potteric Carr as a wetland and wildlife site was realised. The reserve contains a remarkable variety of habitats, each with its associated plant and animal communities (Mitchell , 1996a). The colonisation of open water and the succession of reed fen and willow carr is apparent in several places on the reserve and a good example can be seen at Piper Marsh in **Figure 8.58** overleaf.

Figure 8.58: **Open water and successional colonisation at Piper Marsh, Potteric Carr nature reserve.** (Source: Author).

On the adjacent disused railway embankments the floral communities are developing from low herbs and grasses to scrub and woodland. There are several areas of permanent open water, the most significant being at Low Ellers Marsh, Decoy Marsh, Pipers Marsh, Loversall Pool and Willow Pool. In terms of faunal species the reserve is particularly important for birds with 179 species being recorded and 85 species have been known to breed in the last quarter of the twentieth century. The areas of open water and reed fen are particularly important for wildfowl, waders and reed dwelling species such as bittern (*Botaurus stellaris*) which is seen intermittently, and passerines such as reed warbler (*Acrocephalus scirpaceus*) and sedge warbler (*Acrocephalus schoenobaenus*) (Yorkshire Wildlife Trust, 1986). There are almost annual rarities on the reserve with Little Bittern (*Ixobrychus minutus*) which bred being one of the most memorable (Roberts, 2001). The Carr was designated a nature reserve in 1968. Initially covering 14 hectares, the Potteric Carr Nature Reserve is now one of the UK's largest urban reserves at 130 hectares. It contains 8 kilometres of footpaths, eight hides, and a field centre with a cafe. **Figure 8.59** shows the aims for the reserve in the original 1968 management plan.

Aims of management:

1. ***To conserve representative examples of the existing variety of habitats on the Reserve with special priority being given to wetland habitats.***
2. ***To develop new wetland habitats, where possible, by artificial means and to encourage the development of reed fen in these areas.***
3. ***Subject to conservation constraints and to the conditions imposed by British Railways and the Potteric Carr Internal Drainage Board, to allow the general public, school and others, opportunities for studying wildlife free of charge.***
4. ***To develop a system of water control which will ensure the maintenance of wetland areas, in particular reed fen.***
5. ***To secure buffer areas around the Reserve which are acceptable in their land use.***

Figure 8.59: **Aims of management for Potteric Carr nature reserve [1968].**
(Source: Roger Mitchell, personal communication).

These aims were later (2002) adjusted in light of changing general and specific funding requirements in the reserve's successful Heritage Lottery Fund grant aid. These are shown in **Figure 8.60.**

Project objectives for Heritage Lottery Fund bid for Potteric Carr nature reserve enhancement:

1. *To protect and enhance the heritage value of the existing Potteric Carr SSSI and address increasing pressures from surrounding developments.*
2. *To encourage visitors to the Reserve, given that numbers remain within the Reserve's perceived carrying capacity.*
3. *To expand community involvement in the management of the Reserve.*
4. *To develop a major environmental education and training scheme and support others in developing green initiatives.*
5. *To expand the Reserve, thus making it more ecologically robust and increasing its ability to accommodate larger numbers of visitors.*
6. *To ensure that, following the development scheme, the Reserve is operating in profit.*

Figure 8.60: **Project objectives for Heritage Lottery Fund bid for Potteric Carr nature reserve enhancement.** (Source: Roger Mitchell, personal communication).

A schematic diagram of the habitats at the reserve is shown in **Figure 8.61** and an aerial photograph of the site in **Figure 8.62**.

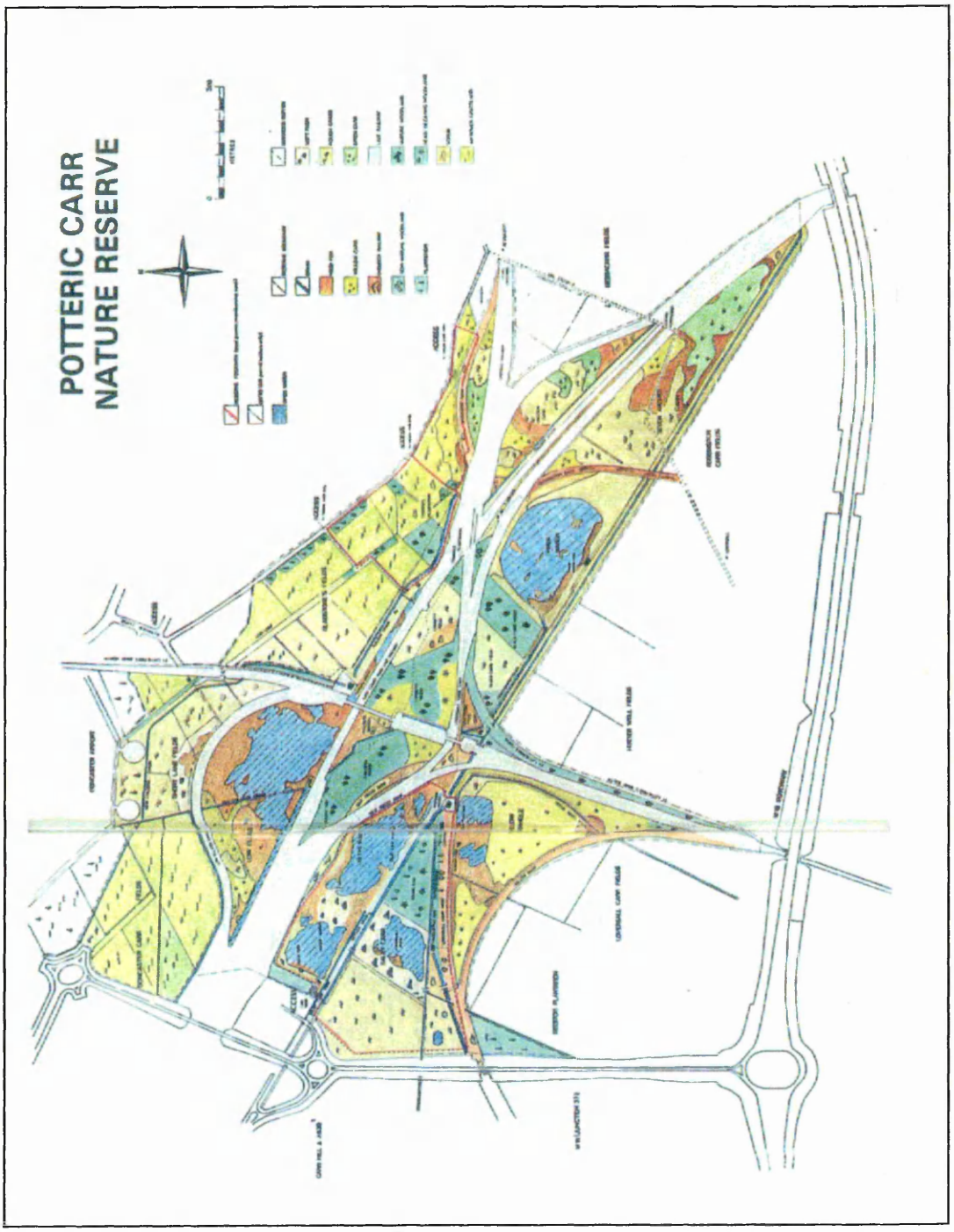


Figure 8.61: **Schematic diagram of the habitats at Potteric Carr nature reserve.**
(Source: Yorkshire Wildlife Trust).

Figure 8.62: **Aerial photograph of Potteric Carr nature reserve.** (Source: Yorkshire Wildlife Trust).

As well as being important for wildlife, the Reserve is also a visitor and educational attraction. However, further drainage in the area in the late twentieth century has resulted in the drawing down of the water table in the area of the reserve known as Willow Triangle which has gradually become much drier. A consequence of this is that the reed fen had been gradually replaced by willow (*Salix* spp.) encroachment. This was resolved in the late 1980s by clearance of the scrub and the provision of a new more permanent water supply. This latter was achieved by pumping water from the Mother Drain (**Figure 8.63**) to the affected areas via tertiary 'polishing' of the water through reed beds and then on to Loversall Pool and finally Willow Triangle (Mitchell , 1996a).

Figure 8.63: **The Mother Drain at Potteric Carr nature reserve.** (Source: Author).

A further problem has been that in recent years much of the original farmland around the reserve has been developed for housing and industrial use, and the 'buffer zone' accorded by this land has been eroded to the extent that the reserve is in danger of being adversely affected. Some of this impact may be direct, but most of it is indirect. For example, some of the water entering the reserve is poor quality, originating from the Balby waste water treatment works, and also including run-off from local industrial estates. The latter are contaminated with oils and industrial residues (Mitchell, 1996b).

Plans for further building development are likely to exacerbate the potential problems both at the edge of the reserve and in relation to its hydrological processes throughout. With the loss of a buffer zone, the reserve could become an isolated environment. Increased urban run-off will further degrade water quality, with the result that the Reserve will suffer in habitat quality and become too isolated to be self-sustaining for many of the wildlife species now present. This trend would threaten the site's emergence as a visitor attraction, a green lung for local people, and as a positive contributor for the local economy.

8.2.5.3 Environmental threats and responses

Those responsible for the site have recognised these potential threats, as well as the opportunities afforded by development plans for Doncaster and funding opportunities through UK and European Union (EU) funding schemes. The Potteric Carr Nature Reserve Development Committee, through the Yorkshire Wildlife Trust (YWT), have developed proposals to protect and benefit the Reserve (YWT, 2002). These include: (1) increasing the area of land covered by the Reserve and so increasing the habitat potential, (2) maintaining a buffer zone around the Reserve (see **Figure 8.64** overleaf) and, (3) in the light of growing environmental awareness of the general public, to increase the educational and visitor potential of the Reserve. To this end the Trust proposes to secure a series of agricultural fields sandwiched between the reserve and the M18 motorway increasing the size of the reserve to approximately 600 hectares. Much of the new land will be developed into new open water and reed fen and managed to benefit bittern and other wetland specific species (Mitchell, 1996a). The education and visitor potential will be through improved visitor management and the expansion of the Field Centre in the middle of the Reserve. Furthermore, within the proposals it is considered important to increase community involvement in the Reserve. This will improve local community empowerment, engender new support, and involve people directly in the emerging development plans and thus in the running of the Reserve.

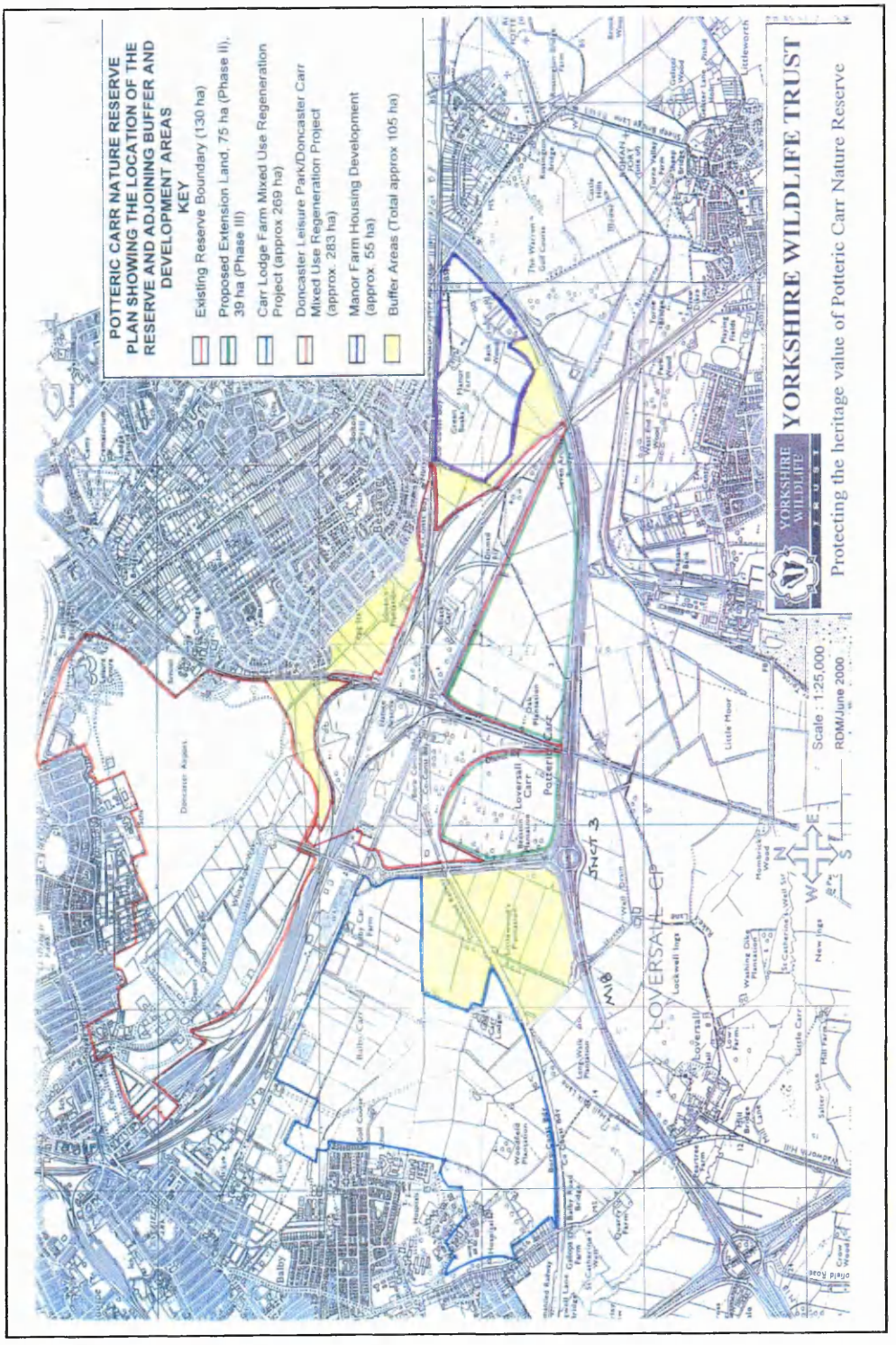


Figure 8.64: Future proposals map for Potteric Carr nature reserve. (Source: YWT).

8.2.5.4 Project funding.

These capital impacts can be broadly separated into those relating to the habitat creation and establishment work, and those relating to buildings and facilities. Included within this the

project management, design and development elements link these directly to employment. The land acquisition and purchase is excluded as this is largely 'dead' money. A breakdown of costs is shown in **Figure 8.65** below.

Habitat creation
Reedbed total project - 75 hectares of new reedbed
1. £164,000 (for 20 hectares first area) plus between £150,000 - £295,000 (for 38 hectares second area), and £100,000 for 17 hectares (third area). **Sub-Total = £414,000 - £559,000**
2. Project management - **£30,000**
3. Hydrological investigation - **£23,000**
Total = £467,000 - £612,00
Woodland and wetland - 39 hectares
1. 18 hectares of wetland from arable - **£100,000**
2. 21 hectares restoring woodland - **£25,000**
Total = £125,000
Buildings and facilities
1. Conservation Centre (including BTCV) **£2,145,000**
2. Gateway project **£615,000**
Total = £2760K
Other capital drawdown schemes
1. Scrapyard remediation **£1160,000**
2. Refurbishment of locomotive shed **£290,000**
3. Car parking and landscaping **£230,000**
4. Project management and design fees *etc* **£512,000**
Total = £2,192,000
Overall Total = £5,808,000 - £5,689,000

Figure 8.65: **Breakdown of costs for Potteric Carr nature reserve.**
(Source: Yorkshire Wildlife Trust).

The main drivers for the creation of the reserve are shown in **Figure 8.66**.

The main drivers for the creation of the reserve were:

* As a result of deep vein coal mining in the area, subsidence of the land has occurred resulting in the creation of large areas of wetland and pools and through the enthusiasm and work of local people, the importance of Potteric Carr as a wetland and wildlife site was realised.
* In view of surrounding potential development threats, as well as the funding opportunities through UK and EU schemes, the Reserve Development Committee has developed proposals to protect and benefit the Reserve. These include increasing the area of land covered by the Reserve and so increasing the habitat potential, maintaining a buffer zone around the Reserve and, in the light of growing environmental awareness of the general public, to increase the educational and visitor potential of the Reserve.
* Roger Mitchell has for long been the 'project champion' for the reserve, both in a voluntary capacity and through his local authority employment.

Figure 8.66: Main drivers for the creation of Potteric Carr nature reserve.

8.3 Summary of findings of the case studies.

Taking into account the history of wetland decline, the development of and changes to the Don catchment and the underpinning review of key, subject-related policy development, the case studies were particularly examined in relation to a number of questions posed that the author considered to have relevance to choice of sites for future development. These included strategic underpinning, how the sites were chosen, funding issues, comparability of aims and the influence of key personnel. These are summarised in the sections below.

8.3.1 Key implications of the case studies.

8.3.1.1 Strategic underpinning.

There is evidence that there is a plethora of strategy and policy that is available at a regional and local level (as evidenced in the review of key documentation in *Chapter 7*), and, in some cases, this has been used to justify proposals for project development. Rother Valley Country park could be said to be strategy-driven in that the recreation and conservation elements were a planning requirement and Woodhouse Washlands was developed as a direct result of being highlighted in the Rother Valley Wildlife Strategy. But Blackburn Meadows and Potteric Carr have resulted from the passion of individuals in influential roles who have used existing policy as justification rather than as an initial driving force.

8.3.1.2 Choice of sites.

Essentially choice of sites seems to have been opportunistic and based on protecting and enhancing existing nature conservation interest. This is very evident for Blackburn Meadows, Potteric Carr, Woodhouse Washlands and Old Moor, although being associated with surrounding regeneration projects allowed development of the reserve on a much larger scale in this latter case. Rother Valley was opportunistic in the sense that it could be associated with a required reclamation scheme and had political underpinning for recreation and conservation use but it also had evidence of former high-quality wildlife value.

8.3.1.3 Funding and finance.

The financial figures presented in each case study have not yet been fully analysed but it is clear that the projects will generate a major impact on the local economy over a development period of several years. The figures may vary with different aspects of the site evaluations and building

designs, however, they should be regarded as conservative since they do not fully include associated developments that will undoubtedly happen as the project runs its course.

The broad idea of the thesis is that substantial public sector investments in major environmental improvement works, and in particular in wetland environmental creation schemes, are being used to trigger significant economic regeneration in the heartlands of the former industrial north of England. The nature of the case study sites and the scale of operation, and hence the level of financial input, clearly has implications for this economic benefit. These projects also bring with them substantial social and environmental improvements that may be intangible and are certainly not quantifiable in financial terms.

In some situations it is difficult to separate the different elements of what are often complex projects. Some of these sites, such as Rother Valley Country Park, are multi-functional facilities – with a nature reserve, a water sports centre and provision for less formal recreational pursuits. Both costs and benefits may be shared. However, a simple inspection of Rother Valley's annual report for example, suggests that staff costs fall roughly into two groups: (a) nature conservation/estate management/stock control (14 full-time and 13 casual) and (b) sports (10 full-time and 40 casual). This allows some interpretation of the nature conservation related component of this resource (Rotherham and Cartwright, 2000b).

Consideration of the five case studies indicates that the economic impact ranges from immediate and short-term (research, design, construction and establishment), to long-term leisure and tourism benefits. The short-term economic inputs may be relatively modest (£1,000 - £10,000) for a site recovery/restoration scheme such as Woodhouse Washlands, to very major (£100,000 - £1,000,000) for reclamation and creation projects such as Blackburn Meadows, Old Moor or future proposals for Potteric Carr. Long-term job creation is difficult to assess with certainty. Rother Valley now maintains around 20-30 posts associated with nature conservation and country park management, whereas other projects, more recently established, have perhaps two to four such posts. The Old Moor project suggested a benefit of eight Full Time Equivalent (FTE) jobs safeguarded or created and eighty-five FTE temporary jobs over the two-year construction period. It was suggested that 85 - 90,000 visitors per year would be attracted by five or six years from opening. However, our assessment is that the necessary leisure and tourism infrastructure for maximum benefits to accrue are neither in place nor yet planned. To achieve the next phase of the project the RSPB have taken over the site from the local authority, and in June 2002 announced nearly £1,000,000 of Lottery Heritage funding for the development work outlined in the case study (Rotherham and Cartwright, 2000b).

It was not possible within the study to apply multiplier effects to the local community and economy, but it is expected that the benefits will rise progressively over time from establishment. It is also expected that as the complexity of sites and their associated infrastructure, along with initiatives such as the *Trans-Pennine Trail* and the *South Yorkshire Forest* continue to develop, the leisure and tourism significance will continue to rise (Rotherham and Cartwright, 2000b).

Although environmentalists have often been suspicious of attempts to 'value' nature, it is argued that:

a. **The economic and social benefits may be a key to the political will to safeguard existing wetlands and to establish new ones.**
b. **The long-term benefits of wildlife leisure and tourism are yet to be fully realised or appreciated.**

The short-term economic and employment benefits are easier to establish and have clearly been used in the arguments to secure funding for the projects close to Old Moor in Barnsley and Blackburn Meadows in Sheffield (and adjacent Rotherham). The economic benefits of these projects provides a further and important imperative for both the conservation of existing wetlands but also for the re-establishment of new ones in formerly degraded areas. It should also be noted that the projected benefits of these projects require close scrutiny. Reasons for over-optimism and for shortfalls in performance would have to be carefully analysed in order to generate models and guidance for best practice. In this way it is intended that the research will influence the future developments and their success (Rotherham and Cartwright, 2002b)

In terms of direct and induced impacts it is expected that the benefits will rise over time from establishment. It is also expected that as the complex of sites and associated infrastructure, along with initiatives such as the *Trans-Pennine Trail,* the *Earth Centre, Magna,* and the *South Yorkshire Forest* continue to develop, the leisure and tourism significance will continue to rise. It is clear that the projects can impact on the local economy. With from 100,000 to 600,000 day visits per year, and site-based staff, these projects might contribute anything from £1million to £6 million per year to the local economy through visitor spend. This may be at the lower end of the figures for visitor spend at nature reserves managed by the RSPB if these are mostly low income, local visits (Rayment and Dickie, 2001). With an induced effect of jobs on the local economy, a 1.44 multiplier to the Rother Valley data would give a total direct impact of site-based nature conservation related employment to be in the region of twenty-nine to

forty-three FTE created (based on a multiplier effect of 1.45 for output, and 1.44 for employment, from environment-related expenditure and employment (The National Trust, 2001) using an Input-Output model to assess the economic contribution of the environmental resource to the economy of Wales). For Old Moor and Rother Valley the impact was related to the investment of construction and development, and there was then an expectation of an ongoing local authority subsidy. There was no calculation of short-term employment or economic impact of the constructional work itself at Rother Valley, but data are presented for Old Moor - around eighty-five full time jobs over a two-year period (Rotherham and Cartwright, 2000b).

8.3.1.4 Case study project aims.

Examination of the aims of the projects described in the case studies shows that some are generalistic, some are tightly focussed, and some indicate the nature of their potential multiple use. What does become apparent is that there is a recognition of the fact that nature reserves are not purely for wildlife but must have some interface with people. This may be because of purely altruistic reasons but is more likely to be linked to funding requirements. Cartwright (1998) describes these benefits in **Figure 8.67**.

The aims of involving people in nature conservation projects can be described as:

* Enabling and empowering local communities and visitors in sustainable management
* Stimulating awareness and understanding of projects and their purpose
* Providing skills / confidence for people to be involved in diverse aspects of projects
* Provoking action
* providing an educational experience
* providing an enjoyable experience

Figure 8.67: The aims of involving people in nature conservation projects.

In summary:

* All the sites reflect important linkages between the environment and its use by people
* Some sites are very focussed on nature conservation
* Some sites reflect the influence of socio-environmental quality on regeneration

8.3.1.5 The influence of key personnel - 'project champions'.

The evidence from the case studies is that the development of wetland nature conservation sites has essentially been opportunistic, either as a result of pressure from threat, strategic encouragement, available funding or available sites. But a key 'driver' to their actual implementation has, in the majority of cases, been the passion and determination of a key individual who motivates others with his / her vision. The author (Cartwright, 2000) describes his experience of this process at the Blackburn Meadows nature reserve and a history of initial ideas that were never 'followed through' but which planted seeds of inspiration in himself. He also describes the benefits of seizing the opportunities of being in the right place, in the right job, at the right time; but showing that these were balanced by difficulties in maintaining motivation and in involving other people.

The role of stakeholders is seen as an increasing element within the policy-making process and in requirements for grant aid. There are dangers of false implications of consensus and whether the stakeholders are truly representative, but strong leadership from charismatic motivators can overcome these issues.

A metaphor for the process for group formation can be proposed through the ecological dynamic of pack, or tribal, behaviour where, despite threats and short-term upheaval there is a strong possibility of the restoration of 'natural' balance. The forces that often 'kick in' are the emergence of tribal or pack leaders who are dominant players. The characteristics of these leaders are that they are charismatic, passionate, can motivate others, are territorial but innovate, and often operate for a long time. The dangers here are that being passionate is often draining and that their sphere of influence can be quite narrow. Another diversity from this is in looking at those project champions who work with a passion but never achieve their goal. This could be due to a lack of charisma, or that they don't operate in the right spheres of influence, or that they are unwilling to compromise or work with the system.

From his experience with Blackburn Meadows nature reserve Cartwright (2000) emphasises the importance of group and stakeholder involvement and suggests requirements for, and dangers of, such partnership projects (**Figure 8.68**).

Initial requirements for a successful project:

* Project champion - passion for project and personal philosophy, leadership skills and qualities, worldliness, clear agenda, capable of maintaining enduring relationships & practical skills;
* Involving all sectors - stakeholders;
* Political will from site owners, politicians, local government officers, diverse voluntary sector groups and grant aiding bodies;
* Involving others with needed skills;
* Media support - promote the project at all opportunities through the media to engender local interest and support;
* Partnerships between public, private and voluntary sectors therefore not competitive;
* Funding skills;
* Employment of key staff;
* Involvement of dedicated staff from partner organisations.

Dangers in group development:

* 'Burn out' of key, active members;
* Apparent 'clique' forming which creates barriers against dynamic membership;
* Dependency of some members rather than shared responsibility.

Figure 8.68: Summary of key features of a partnership project. (Source: Cartwright, 2000).

It is believed that, because such projects are complex, often meet barriers, and require a diversity of skills, every development must have a determined project champion. Sometimes it not always easy to identify them, but predominantly they are very obvious.

In summary:

* Most sites show evidence of the need for, and influence of, people with passion to drive a project on through bureaucracy and lack of resources.
* Regular meetings of stakeholders and interested parties allows an airing of views, the opportunity to network and to access innovatory developments.
* Partnerships involving public, private and voluntary interests provide a more cohesive approach to product development. Individual members can often identify and access

different sources of funding and grant aid, they can bring different skills and expertise and may well be influential in securing permissions for work to take place.

* Identifying stakeholders and partnerships is crucial to strengthening the desirability of funding bids.

8.3.1.6 Other case study indications.

* In terms of site development there is strong evidence of innovation in design, management techniques and fund-raising.
* There is evidence of the growing importance of tourism, access and recreation.

9.0 FOCUSSED INTERVIEWS WITH KEY PERSONNEL.

9.1 Introduction.

The first task of this research method was to identify the key personnel to interview and to ensure that they provided a depth and breadth of experience, responsibilities and focus. Completion of a 'stakeholder analysis' was considered but it was decided that this method of identification would only partially be appropriate as it is designed to identify people who would be involved in decision-making and implementation for a specific project. This study is more strategic in nature and does not aim to promote specific projects, but hopes to provide a context in which such projects may materialise in the future. However, the author has a long professional involvement both in the local and regional area and in strategic policy-making for the Sheffield District. He has also worked closely with fellow professionals working in the region in the public, private, voluntary and academic sectors related to the topic area. The choice of key personnel for the focused interviews was made by the author based on this experience and on this network. Many of the chosen interviewees were all judged to be 'project champions' as described in *Chapter 8*. Thus the choices made are subjective and may display elements of bias but the results will stand or fall on those decisions.

People representing organisations with a strategic overview or influence on the catchment area would need to be targeted and three separate groups were identified. These were the regional offices of governmental advisory agencies, a representative sample of local authorities and a representative sample of the voluntary environmental sector. The regional government advisory organisations were limited in number and therefore each appropriate organisation could be part of the sample. At least twelve local authorities (at both county and district/borough level) have administrative boundaries within the Don catchment and it was decided to sample those within which the majority of the catchment lay. There is a multiplicity of organisations within the voluntary sector with influence in the catchment and it was decided to provide a range of such bodies related to size of membership, area of interest and degree of independence. Respondents were chosen on the basis of their role in the organisation in relation to the research topic. Some were seen as having a key strategic policy-making role such as the representatives of the government advisory agencies, Derbyshire County Council and Sheffield City Council. Others were more practically involved in the topic area but would also have some strategic influence. These would include the representatives from Barnsley, Rotherham and Doncaster Borough Councils. The voluntary sector representatives were more mixed and give a different set of viewpoints. The larger voluntary organisations have an increasing strategic influence at local and regional levels and in this respect the representatives from the Royal Society for the

Protection of Birds and Sheffield Wildlife Trust provide this outlook. It would be expected that the Yorkshire Wildlife Trust representatives would also have this focus but they were consulted more in their local context as key players at important local sites. However, their representative, Roger Mitchell, has an extensive background as a local authority strategist at Borough and County level before retiring, and as a former Chair of the Yorkshire Wildlife Trust, and thus his response has a great depth of rich experience. Some respondents were directly contacted by the author and agreed to take part in the research but some were nominated by respective organisations as being best-placed to represent them. However, all respondents in this category were known personally by the author. Respondents are shown in **Figure 9.1**.

Regional government advisory agencies.	
Countryside Agency, Yorkshire and the Humber.	Stuart Pasley, Senior Countryside Officer.
English Nature, Humber to Pennines Team.	Tim Kohler, Conservation Officer.
Environment Agency, North East Region.	Chris Firth, Fisheries Officer.
South Yorkshire Forest.	Richard Walker, Director.
Local authorities.	
Sheffield City Council.	Valerie Greaves, Planning Officer.
Rotherham Metropolitan Borough Council.	Philippa Harvey, Countryside Officer. Kathy Hamilton, Countryside Planning Officer.
Barnsley Metropolitan Borough Council.	Phil Tierney-Kitchener, Countryside Officer.
Doncaster Metropolitan Borough Council.	Martin Nowacki, Head of Countryside Team.
Derbyshire County Council.	Annie Cooper, Planning Ecologist.
Voluntary sector.	
Sheffield Wildlife Trust.	Nigel Doar, Director.
Yorkshire Wildlife Trust, South Yorkshire Area.	Roger Mitchell.
Royal Society for the Protection of Birds, North West Region.	Harry Bowell, Regional Reserves Manager.
Woodhouse Washlands nature reserve management committee.	Christine Handley, Chair.

Figure 9.1: List of key personnel as research respondents.

9.2 Interview process.

Interviewees were each sent a copy of a short document outlining the background to, and objectives of, the research (see **Appendix 3**), together with a list of suggested topic areas for discussion. This list was formulated to try to establish the viewpoints and knowledge of the respondents relating to a variety of issues affecting the catchment and the research questions. The topic areas are very similar for each respondent but do have a degree of variance related to each respondent's particular area of expertise or responsibility, or to the geographical extent of

their organisation's area of interest. Some respondents would have strategic views at regional or even national level whereas others would be very focussed on particular sites or small areas within the catchment. An example of a topic list is shown in **Figure 9.2**.

Environment Agency, 2002.

Topics of interest in my research on the River Don, its tributaries and associated wetlands.

* **Strategic thinking on River Don / River Dearne / River Rother catchment and / or specific stretches.**
    * The Environment Agency's vision? What is to replace the catchment LEAP?
    * What reference is made to other agency's / authority's strategic vision?
    * What are the immediate effects of the Water Framework Directive?
    * What are the next steps with the Water Framework Directive?
    * What links are there to other agency strategies e.g. Countryside Agency, etc.?
    * What are the constraints and barriers that prevent implementation?
* **Identification of key wetland areas and / or river stretches in the catchment area.**
    * What evaluation has been carried out?
    * What are the criteria for site selection?
    * What past, current or future initiatives for restoration, rehabilitation, or habitat creation are there for wetlands and river stretches?
* **What key economic associations are there for wetlands in the river corridor?**
    * What are the key industries? Are they prospering or in decline?
    * What agricultural management is there? Are these changing?
    * What links are there between nature conservation, greenspace and recreation/tourism projects with social and economic regeneration?
* **How do irrigation/drainage issues affect nature conservation / leisure objectives?**
* **What major pollution issues are there in the river catchment?**
    * Point source?
    * Diffuse sources?
    * Is use made of constructed wetlands to mitigate pollution sources?
* **How do flood control measures enhance or restrict nature conservation / leisure objectives?**
* **What objectives are there for restoration of the rivers as fisheries?**
* **What access issues are there?**
* **What partnerships exist to promote river/wetland management and other initiatives?**
    * Communities?
    * Voluntary sector groups e.g. YWT, RSPB, etc.?
    * Other agencies e.g. Countryside Agency, DEFRA, English Nature, etc.?
    * Other authorities? (Particularly in view of the fact that rivers cross administrative boundaries).
* **What funding issues are there?**
* **What policy documents exist related to river catchment issues?**

Figure 9.2: Example of suggested topic areas for discussion sent to research respondents.

It can be seen that the design of the topic areas for discussion is an intentional mixture of both generic and specific sections and, as mentioned previously, issues relating to the respondents sphere of influence or interest (i.e. do they have a catchment-wide interest or are they specifically area based within it?). It proved impossible to provide a set of topic areas that every respondent could address. For instance, issues relating to flooding are far more relevant in the downstream section of the catchment than its northern and western areas. It is also feasible that the choice of topic areas is subject to the author's preconceptions of the issues affecting the catchment. However, this can be either a positive or negative effect.

9.3 Topic area objectives, constraints and analysis.

The objectives of the construction of the discussion topic areas and their subsequent analysis have been to identify themes and/or influential relationships, patterns and processes. It was also hoped that commonalities, generalizations and possible distinct differences could be identified alongside recognition of alternative explanations. The analysis would need to avoid oversimplification of issues and the dangers of de-contextualising the responses. In practice a variety of responses was obtained. Due to time constraints on the part of the respondents four of the responses were in written form and thus, to a limited extent, some were not as well developed as the author would have hoped. The advantage of focussed interviews is that themes can be developed but with written responses this was not possible. However the disadvantage of developing themes is that the discussion can drift away from the focus of the research questions. The difficulty with this is whether to follow these new directions as they could prove to be 'red herrings', but they could equally challenge the preconceptions of the author and develop new research areas.

Time availability for the respondent interviews was also a potential limiting factor on the depth of the discussion. Some respondents allowed this to come to a 'natural' conclusion but others could only allow a fixed period of time. This restricted the topics that could be covered and thus required prioritisation of the topics covered.

The temptation is always to make comparisons between what has been said by the different respondents yet it must also be recognised that they are responding from very different points of view, with different responsibilities and accountability, with different levels of experience, from a strategic or practical viewpoint and with passion or impartiality. Most of the respondents are theoretically presenting the viewpoint of the organisation they represent yet this can be tempered by personal views. It is also difficult to establish the reliability of an individual's

response in relation to their organisation. Notes taken at the time of the interviews, or the written responses, are contained in **Appendix 4**.

Figure 9.3 shows a table estimating the strength of response or relevance to topic areas. A graded system from *'A'* to *'E'* is used where *'A'* represents a targeted response or strong awareness and *'E'* represents a view that is non-specific to the river system or demonstrates a lack of awareness. *'O'* is indicative of the topic area not being covered in the interview.

	Strategic thinking	WFD awareness	Site Evaluation/ Selection	Economic Associations	Practical Constraints or Opportunities	Partnerships	Funding Issues	Policy Documentation	Restoration/ Access
Countryside Agency	A	A	D	A	B	A	A	A	C
English Nature	C	C	C	D	B	B	C	C	B
Environment Agency	A	B	B	B	A	B	C	B	A
South Yorkshire Forest	A	O	O	A	A	B	A	B	B
Sheffield City Council	C	E	O	C	D	B	B	B	C
Rotherham Borough Council	B	E	C	B	C	B	B	B	B
Barnsley Borough Council	B	E	B	B	C	B	B	B	A
Doncaster Borough Council	B	D	B	B	B	C	B	B	B
Derbyshire County Council	A	E	B	B	B	B	B	A	B
Sheffield Wildlife Trust	C	E	D	B	B	B	A	D	O
Yorkshire Wildlife Trust, Potteric Carr	A	O	B	A	B	B	A	O	A
Yorkshire Wildlife Trust, Woodhouse Washlands	C	E	D	B	B	B	C	E	C
Royal Society for the Protection of Birds	A	A	A	B	B	B	A	C	A

Figure 9.3: Table estimating the strength of response or relevance to topic areas.

It must be recognised that this analysis of responses is highly subjective in that the differentiation between, for instance, 'A' and 'B' is very hard to justify, but at least gives a flavour of how the author himself responded to what was being said. It also requires a differentiation of what is understood by the respondent but which does not reflect his employer's

or group's perspective. For example, several local authority officers were aware of the implications of the WFD but responded that their Authority was not prepared for this. It must also be accepted that the author was influenced by the nature of the conversation with the respondents and not only with the reported interview results. He would also be influenced by previous contacts and working relationships with some respondents.

9.4 Summary of findings.

9.4.1 Areas of concern.

The findings of the focussed interviews have identified significant areas of concern. There appears to be a worrying lack of awareness of the WFD in all three groupings of interviewees despite the major implications this will have on cooperative working, stakeholder consultation and involvement, cooperative funding bids and policy development and implementation.

There also appear to be significant communication barriers at many levels. Between government agencies there appears to be no uptake of responsibilities in relation to policy other than their own organisational output. In relation to the WFD some agencies suggested that they didn't need great responsibility because the Environment Agency had been given the lead responsibility and they were waiting to be consulted. There were also indications that even within each agency there were communication breakdowns between different departments.

The voluntary sector tended to be very site focussed and, even if included within strategic stakeholder consultation, would only relate this to their specific sphere of influence.

The local authority sector either did not see the working implications of some policies being generated at a higher level, or would be selective as to what to develop on a local basis. Much of their concerns were focussed on planning implications. Most officers in this sector had to prioritise what issues to focus on and seemed to be limited to such things as reviews of Unitary Development Plans or in formulating Community Strategies.

All sectors identified lack of resources in being able to address new policy directions and their implications.

9.4.2 Specific themes and trends.

The interviews identified that there was strong policy formulation at local authority level . The question arising from this and, posed by some respondents, was whether these policies were purely a 'paper exercise' and were never, or rarely, implemented in full. There also appeared to be strong strategic direction at government advisory level but, again, it was questioned as to whether this was disseminated to lower levels in the hierarchy.

As indicated in the previous section a lack of strategic involvement for the smaller voluntary sector organisations was identified despite the fact that there was also strong evidence of the existence of some multi-stakeholder partnerships where it suited member's aspirations and focus.

A key feature of the interviews was the evidence of regeneration activity, the involvement of all sectors in this and how projects could be linked to this social and economic activity for funding and resources. It was evident that there is strong recognition of environmental importance in socio-economic regeneration.

9.4.3 Outstanding or surprising results.

* The RSPB's change of attitude in relation to site acquisition and partnerships in moving away from only acquiring the best bird sites to a policy of people and wildlife interfaces and strategic positioning to address issues of climate change on habitats and species presence.
* The poor awareness of the local authorities, and the implications for them, from the implementation of the WFD as discussed above.
* Confusion about, non-use, or poor adaptation of site selection criteria with conservation sites being identified for management or development on a far more opportunistic basis of selection using a mixture of site availability, funding opportunities, 'political' support and individual whims.
* Lack of awareness of most voluntary sector organisations (other than the RSPB) in the WFD process.
* The opportunities for environmental projects within regeneration initiatives in the Don catchment.

These findings are reflected in the findings of the case studies in *Chapter 8* and are further discussed in the following chapter.

10.0 DISCUSSION AND CONCLUSIONS - THE IMPLICATIONS OF THE DATA.

In concluding the study there is a requirement to examine the results of the research methods against the main thrust of the research project that the primary aim of the study is:

To increase the knowledge and understanding of the issues relating to water and wetlands as key components of regional environmental, social and economic resources;
and within this that:

1. ***Wetland management, enhancement and creation (all aspects of restoration and rehabilitation) may present significant opportunities as a platform for regeneration and for balancing former environmental loss and degradation.***
2. ***Wetland restoration projects are critical in facilitating social and economic regeneration at local and regional levels.***

What has become evident in the course of the research is that the subject area is very complex and has multiple stakeholders. But this means that there is richness to the ideas and activity that are taking place. The difficulty is in trying to place some sort of order into this complexity and to assess whether there are any identifiable trends or if it is all haphazard and there is no sense to it.

In *Chapter 6* it was stated that it was intended to use triangulation as a method of interpreting the data obtained from the critical review of the literature, the close-up examination of pertinent case study projects and the views of key personnel in differing sectors of the subject area in the region. Such interpretation through triangulation must address the questions as to what has been discovered and where does this lead to? This study has identified a richness of data and this has been achieved through a determination to obtain detailed thoroughness in the literature search, critical choice of interviewees and a depth of personal knowledge of projects, personnel and strategy.

In general terms of what the interpretation of the data has discovered, the literature review has been a fact-finding mission that provides the basis on which concepts and theories for the subject area have been defined. A weakness in the literature is related to who writes it. The authors may be acting as 'gatekeepers' who display bias with an agenda to influence towards a particular viewpoint. There may well be viewpoints missing from the discussion. But this does help to justify the use of case study research and focussed interviews to add value to this

enquiry. They bring in, to a limited extent, what is missing and thus enhance the research validity and reliability.

The case studies and the views of key personnel have also revised the actuality of how these concepts are being implemented. The issues involved have proved to be complex and, in some respects, puzzling, but that is the 'real world' nature of strategic implementation. These findings have provided both positive and negative links to theory and have identified patterns, trends and differences (of both action and opinion). The case studies and focussed interviews have identified differences in approach as well as comparable influences and implementation.

The research has essentially been both explanatory and exploratory. Explanatory in that it has advanced the knowledge in a regional context of the underlying processes of project development. There is therefore now a more complete knowledge of these processes.

The exploratory findings of the research have also identified extensions to the principles that are accepted universally, and suggest that there is a need for new or adapted theories to be formulated.

Overall the research has demonstrated a situation where the strategic influence is recommending broad-scale, integrated development yet the reality is that relatively small-scale, opportunistic projects are being developed on the back of strategic influence and economic and social regeneration schemes.

There would appear to be several significant areas of influence or 'drivers' for change. From the research conducted these would appear to be the roles of policy formulation and legislation (particularly in relation to threat responses); changing agricultural markets and practices, changing economic activity (e.g. tourism) and post-industrial opportunities; the effects of climate change on the preceding issues; a political push for 'quality of life'; partnership opportunities and the crucial role of key individuals or project champions.

Evidence for all these exists across Europe. These drivers are what define the patterns and the shape of the research. In order to construct inferences from this data the drivers must be analysed in greater depth. **Figure 10.1** shows an analysis of the strengths, weaknesses, opportunities and threats discovered within the research. References to these are developed further in the sections that follow.

STRENGTHS

* Strong support for integrated management
* Environmental projects can help promote social/economic regeneration
* Increasing recognition of the value of wetlands in terms of flood retention benefits, biodiversity targets, recreational value, aesthetics and well-being
* Cooperative ventures maximise allocation of resources
* Richness of ideas and activity taking place
* Stakeholder involvement promotes greater acceptance of, and involvement in, projects
* Involvement of 'project champions' ensures greater possibility of a successful project
* Existing case study exemplar projects are successful and developing
* Small-scale projects are easier to design, implement and manage
* Recognition of the importance of the people/nature interface

WEAKNESSES

* There are barriers in the process of implementing policy through to local action
* There appears to be an inability to value wetland functions and processes against other objectives
* The reality is opportunistic, small-scale projects as opposed to large-scale integrated developments
* There is a lack of funding and other resources, particularly for management and other revenue needs
* 'Project champions' are few and far between and are often inhibited by multi-task work pressures
* The complexity of integrated project development
* Project development is opportunistic and haphazard
* Potential bias and personal agendas in those formulating policy which may result in viewpoints being omitted
* Lack of available greenspace, particularly in urban areas
* There appears to be a lack of communication between and within organisations

(Continued overleaf)

OPPORTUNITIES

* New sources of funding may be allocated to implement the WFD and agri-environment schemes
* Environmental projects can be implemented on the back of other regeneration projects, particularly in areas where there has been decline of major industries
* Changing agricultural practices and land required for flood retention may allow environmental projects
* Integrated management both in terms of economic, social and environmental development may allow shared resources and skills
* Integrated management both in terms of cross-boundary and cross- agency working may allow shared resources and skills
* Tourism strategy, planning and initiatives may allow environmental developments
* Future initiatives can be linked to existing projects e.g. the Dearne valley 'necklace of jewels'
* More promotion of stakeholder involvement in projects to promote partnerships with shared objectives, enhanced skills banks and more funding opportunities
* Development of 'best practice' guidelines and demonstration projects
* Recognition of the importance of the people/nature interface
* Habitat creation can mitigate for lack of available greenspace, particularly in urban areas
* Environmental projects can act as nodes of visitor attraction
* Diversification of land and water management can regenerate markets for wetland products

THREATS

* Where are the up and coming 'project champions'?
* Policy documents often 'sit on the shelf' and are not implemented or ignored
* Environmental objectives in policies are often see as having a lower priority than others
* More time is often spent on policy formulation than on its implementation
* Climate change may significantly affect policy formulation and planning and local biodiversity
* Regeneration and flood amelioration projects may make derelict or neglected land (both urban and rural) more valuable and thus more scarce

Figure 10.1: A SWOT analysis of the findings of the research.

10.1 Strategic planning and legislation.

10.1.1 Policy formulation.

The documentary evidence has indicated the need for sound strategic policy influence for project development at both regional and site level. It has also identified other influences which may have either positive effects on site selection and development, for example pollution (e.g. constructed reedbeds for pollution treatment which are also valuable wildlife habitat), regeneration, changes in agricultural land needs, capital funding opportunities, research pressures; or negative effects such as the effects of pollution, changes in agricultural practices, shortage of revenue funding, and lack of coordinated strategic planning.

The evidence from the cooperative ventures on the Rhine and the Danube (see **Appendix 2**) show the importance of agencies and authorities working together to solve water management issues. Without such agreement and cooperation no long term solutions could be envisaged. Although the River Don does not have international administrative and legislative barriers to overcome, there are still issues related to inter-agency rivalries and the past reluctance of local authorities to work together, mainly due to competition for scarce resources.

One problem with an examination of the documentation has been to identify how far down a 'trickle system' from policy-maker to local implementer the information will spread, and equally, how practical experience of implementing strategy is passed up the system to the policy-makers. The question needs to be asked as to who has access to the documents. An example of this is that WWF Europe is a main 'driver' and very influential in strategic thinking on aspects of the Water Framework Directive, but there is no evidence of their influence at regional or local levels. There appear to be crucial gaps in the communication stream.

10.1.2 Threat responses.

There is also a socio/political aspect to strategic policy-making in that policy and legislation is often a last resort to pressure of events (e.g. the autumn, 2000 floods). There is often great resistance to change until the pressure is overwhelming. However, people's reaction to opportunities presented by threats results, eventually, in changes in political thinking. Another factor that is not yet clearly predictable is the issue of climate change which adds a new dimension to strategic planning. There is no certainty that the projected effects will be as proposed or as to the timescale on which changes will happen, but Berry (2002) proposes that there will be a need for significant change in conservation policy to cope with the effects of

climate change over the next fifty years. Tourism and recreation patterns and fashions may well also change with a changing climate.

10.1.3 Post industrial opportunities.

Although the study has examined the effects of habitat rehabilitation and creation within the River Don catchment at specific sites, these may indicate objectives that can be achieved within the catchment as a whole. The river and its environs have a diverse physical structure associated with land use that is dynamic. They provide a focus for the landscape character of the area and, with sensitivity to locally indigenous plant communities, can provide a diversity of habitat types and recreational opportunities that are so admired by the general public. The habitats associated with the freshwater catchment are equally dynamic but they are also fragile, and display a susceptibility to a variety of physical interventions. Sometimes it is relatively easy to fund development projects but it is far harder to find the necessary resources for management, staffing and maintenance without which the project will revert to something far less desirable and accessible. Post-industrial projects are often close to human habitation and can provide an excellent opportunity for a people and nature interface. Not only are such sites providing a valuable educational experience of what is there on the site, but they can also be used to widen opportunities for environmental awareness. For instance, the Don catchment could be used to examine the functions and processes of wetland functions, processes and historical use as described in *Chapter 4*.

10.1.4 Integrated catchment management - the hope for the future?

Hopefully, the ongoing introduction of the EU Water Framework Directive through the early years of the 21st century will promote much greater integrated management of the catchment. This should bring together a co-ordination of the diverse interests involved, with a prime aim of protecting and enhancing natural heritage within the whole catchment. Scottish Natural Heritage (Anon., online, 2002 [b]) actively promote improved riparian zone and catchment management, river engineering activities and urban water cycle management through targeted regulation, 'best practice' guidance and Codes of Practice, using designated sites to develop demonstration schemes. Initiatives in the Humberhead Levels (some of which lies in the River Don catchment) already reflect elements of this good practice with representatives of diverse interests looking at development and promotion of the area's industrial, agricultural and tourism potential. Similarly, but approached in a different way, the regeneration of the Dearne valley demonstrates the rich benefits of integrated objectives and a partnership approach. So successful has this been that it has contributed to a significant change in policy relating to reserve acquisition by the

RSPB. These regeneration initiatives are viewed in the context of the rich natural heritage on which they depend.

10.2 Conservation issues.

Urgent attention in wetland areas is required if the natural functions, processes and aesthetic value of a catchment's natural heritage are to be conserved. The research has examined the outlook for changes in agricultural practices which could be crucial, particularly in view of changing crop patterns with climate change, changing markets and releases of land from production. Opportunities for agricultural diversity can exist with greater promotion of agri-environment projects and within these the potential of Countryside Stewardship to compensate for loss of production. Many agricultural enterprises can link nature conservation to sustainable farming practice and equally into tourism enterprises. Indeed, the '*Value in Wetness*' project in the *Humberhead Levels Initiative* has been planned to contribute to, and merge with, the new Environmental Stewardship Scheme. If agricultural practices can be changed **and** maintain income for farmers, then land that is currently drained to promote agricultural intensification can be managed in a more traditional way to provide seasonal aspects of flooding which will diversify the natural heritage interest of the area (Hogan and Maltby, 2002).

10.3 The importance of the 'people' aspect.

If environmental issues are linked to socio-economic regeneration then the special sites and spaces that are identified or created must have some interface with people. In pragmatic terms most grant aid for conservation projects requires provision for this interface. The work of Ulrich *et al* (1991) and others, has clearly shown the emotional and health benefits of contact with nature. Spaces create memories, fears and experiences that develop people and influence them throughout their lives. Every 'place' is special to someone despite the love / hate tensions associated with some. For example, brownfield sites can be seen as derelict and contaminated but to others can be rich educational sites or have nostalgic value in their link to what was once the community lifeblood in terms of employment and social structure. Each site is seen differently by different people, there is no one general public perception. The key to providing the people/nature interface is that sites should have good accessibility; there must be an element of quality to them (in terms of welcome, comfort, safety and interest); and there should be some meaning to why people go there. These are key elements of future research to assist in planning.

10.4 The implications of the case studies.

The case study evidence has raised several important points. Firstly, it is clear that substantial public sector investment in major environmental improvement works can trigger significant economic regeneration in former industrial heartlands. A 'green' frame, and in particular a wetland theme, seems to attract inward investment and development. This not only attracts direct and indirect employment opportunities, but usually provides an improved infrastructure and social and environmental improvements that are less tangible and certainly less easy to quantify in financial terms. Many funding agencies will only grant aid schemes that have a mix of interested organisations, and often those that provide linkages for economic, social and environmental dimensions. Within the case study evidence there are examples of good practice in this respect, particularly at Old Moor, Blackburn Meadows and in the Humberhead Levels. There can be no doubt that the addition of conservation (in the form of wetland development) to such rich partnerships can only add value to the economic and social revitalisation of local areas.

The case studies also help to illustrate research that suggests that contact with nature enhances physical health and promotes psychological well-being. In such a highly-populated, urbanised region in which the Don catchment is located, greenspace is at a premium and essential for people to escape, 'de-stress' and relax in. In many situations the case study sites promoted active involvement of local communities and other groups and this interface of nature and people can serve to stimulate environmental awareness, develop skills and confidence and provide an arena for social interchange.

Considered by the author to be highly significant is evidence from the case studies that the role of a 'project champion' is crucial to the successful development of a project. Such 'champions' were seen to be tenacious and skilled, but equally to be in positions of influence. The evidence suggests that rather than projects being 'top-down' influenced by strategy and policy, 'project champions' would be visionary and opportunistic, using influence and policy to effect ideas for particular sites they were passionate about. Knowledge and use of policy is seen as a way to make things happen rather than as an inspiration for ideas and projects. In effect these were 'bottom-up' scenarios. Such visionaries tend to attract others to be involved through their obvious passion and their persuasiveness. As a development of this visionary-led approach the case study research also suggests that involvement of key stakeholders is also crucial. These can be wide and varied dependent on the individual project but may include landowners, politicians, advisory bodies, funding agencies, specialist interest groups, local communities and individuals.

Such involvement provides a diversity of skills and influence that can overcome many barriers to project development.

10.5 Projections into the future.

The evidence of the focussed interviews is that there is no real vision for river corridors, and this is particularly evident in the interview with the Sheffield City Council officer. But this may be the result of individual opinion and attitude. But it does signify potential positive or negative bias from individuals in strategic roles. The interviews also highlighted critical factors in relation to lack of communication between and within organisations and this helps individuals and organisations to avoid responsibility and act with an attitude of it being 'someone else's problem'. There is also strong evidence from respondents of the opportunistic nature of project development and particularly in the light of a strong regional push for economic and social regeneration which promotes a place where people can live, work and recreate in a pleasant and healthy environment.

The evidence has described a pattern of process that is shown in **Figure 10.2**.

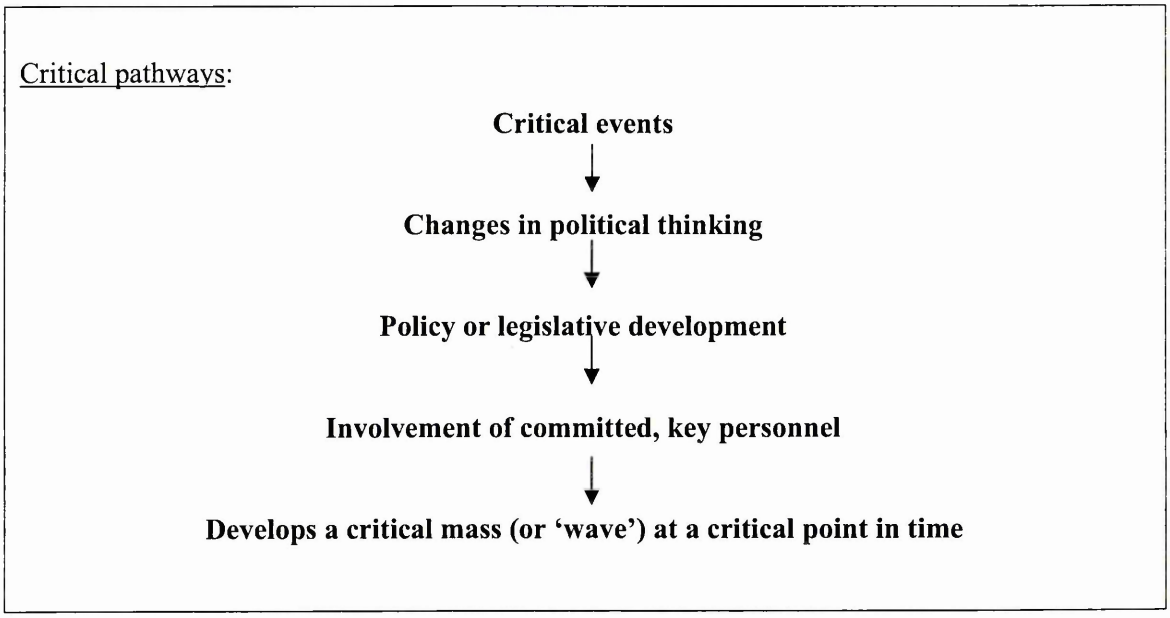


Figure 10.2: Critical pathways of change.

In a local context, these pathways are shown in **Figure 10.3**.

Critical pathways in the development of the Don catchment:

Critical events =

1. Decline of mainstream industries
2. Decreasing level of pollution
3. Expected influence of the Water Framework Directive
4. Expected re-designation of agricultural land as flood retention cells

Changes in political thinking =

1. Values placed on a 'green' frame for regeneration
2. Changing economic markets and trends
3. Availability of land following changes in agricultural practices and industrial decline
4. Availability of European Union funding
5. Availability of central government funding

Development of policies and legislation =

1. Influence of international and EU policy
2. Policy development for regeneration
3. Development of land use planning to target regeneration
4. Reform of existing legislation e.g. the Common Agricultural Policy
5. Planning Policy Guidance

Involvement of key personnel =

1. Those identified and those to come
2. Projects sponsored by grant aid will attract project development teams
3. Controversial plans will identify leaders of pressure groups that subsequently form

Critical mass at critical moment =

1. Development of conservation and recreation projects 'on the back of' regeneration projects
2. New vision of water and wetlands as something desirable
3. 'Trendy' vision of waterside development
4. The Environment Agency response to recent flood events in searching for, and acquiring, flood water holding areas

Figure 10.3: Critical pathways in the development of the Don catchment.

What is very clear is that there is a causal change to new viewpoints and visions of water and wetlands as valuable assets in both aesthetic and functional ways. For example, the development with the River Don as a strong selling point shown in **Figure 10.4** could never have happened if pollution in the catchment was still rife. Hogan and Maltby (2002) state that current approaches to wetland protection tend to be site-based, reflecting land ownership and legal impositions, rather than on an ecosystem or catchment-based approach. But policy makers and practitioners are now adopting flood management strategies as opposed to flood defence strategies and this provides opportunities for the creation of, or adaptation to, floodplain wetlands. Biodiversity Action Plans will raise the profile of wetlands and could result in legal protection for valuable sites. Education to highlight the potential of wetland functions to positively impact on people's quality of life will have significance in any attempt to develop an integrated management approach. Public acknowledgement of these values will influence political targeting of resources and may help to resolve conflicts of wetland management that have proved difficult to arbitrate in the past (e.g. draining farmland).

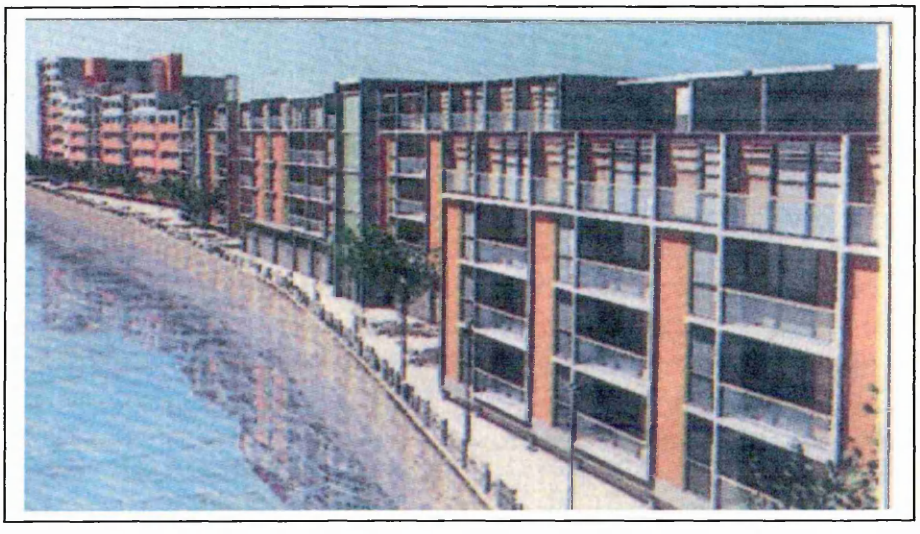


Figure 10.4: **Promotional material for a riverside development.** (Source: Sheffield Telegraph).

There will still be conflicts despite this new positive vision for water. An example would be inevitable disputes between anglers and potential water-borne recreation. Also, as initial regeneration projects act as catalysts for further investment in development, land will become a valuable (and potentially scarce) commodity in which conservation and recreation projects will always be a 'poor relation'. There may also be conflict as grade 1 agricultural land is designated for flood retention cells and be compulsory purchased. But, despite the fact that the implications of the Water Framework Directive may well trigger initial confusion and competitiveness, these

should be overcome allowing resources to be attracted to projects in which nature conservation is prominent.

Adams (1996) suggests that if we are to be serious about nature conservation a debate will have to be widened to consider changes in the way the economy and society are organised. He goes on to say that future nature will be determined by the choices made about living standards, economic growth and economic organisation. But integrated management is often confusing in practice and needs a designated lead coordinator (Tucker and Evans, 1997). Despite lack of awareness of coming change at a local level, indications have been identified in the research that are very positive. New economic activity will create new and valuable landscapes and habitats. Evidence for this is already apparent in the research project's case study sites investigated. But, as Weddell (2002) suggests, the cultural, political, economic and ecological circumstances of each situation are unique and there are too many variables to easily prioritise sites for development. There is no substitute for understanding the minute detail and complexities of both the biological and cultural contexts of sites where we wish to integrate use with protection. Decision-making in these circumstances could be (and perhaps should be) protracted, and involve interdisciplinary cooperation and flexibility. If tourism is to be embraced as a new and growing initiative in the Don catchment then the planning currently being conducted in the Humberhead Levels in the north of the catchment needs to be extended into the remainder of the catchment. Water corridors, wetlands and habitat developments will be crucial in providing access links and nodes of visitor attractions. They can act as discrete, high profile sites within the context of what could be viewed as a flat and uninspiring landscape in the lower part of the catchment. But crucial to this is the development of a necessary local infrastructure.

The experience of a strategic investigation of the future of wetlands in the Fenland area of eastern England has been that there are markets for non-agricultural products such as reed, energy coppicing, wood and fibre products, but the net income will be less than the net farm income for the same land to be used for arable production (Morris *et al*, 1997). But if these economic incentives are linked to vital flood retention functions then there could be significant added value that negates these financial differences. In his responses in the research focussed interviews Harry Bowell raises the issue of the potential of such non-agricultural production for the Don and Aire catchments. He suggests that these are feasible on a commercial scale and states that the RSPB will be actively investigating potential sites.

Wescoat and White (2003) suggest that changing social values have shaped all of the water and environmental problems that exist today but there now appears to be a change in social values and more recognition of the positive aspects of water and wetlands that are likely to initiate a

regeneration of wetland features to former values. Because the public attitude to water and wetlands appears to be entering such a positive phase the much quoted four lines of Gerard Manley Hopkins poem 'Inversnaid', which encapsulated the minority views of conservationists up to the recent past, no longer seem as urgent.

> *"What would the world be, once bereft*
> *Of wet and wildness? Let them be left –*
> *Let them be left. O, wildness and wet;*
> *Long live the weeds and the wilderness yet".*
>
> (Gardner and Mackenzie, 1967).

The result of present and future nature conservation initiatives may not be classed as 'wilderness', but there is a glimmer of progress towards rehabilitation and creation rather than a history of destruction and loss. If there is a future of wetlands to be seen throughout people's familiar landscapes then there could well be an even greater significance in socio-economic regeneration with such areas becoming the 'draw' for tourism and recreation. With new views of the value of wetlands in flood retention and control then the possibilities are immense and this can only be of benefit to local economies. An example of such radical change, although perhaps on a different scale, is seen in the effect on the local economy of the area around St. Austell in Cornwall where the Eden Project (in a former china clay quarry) has attracted hundreds of thousands of visitors who also stay and spend in the wider local area.

Certain aspects of such revived (but different) economic initiatives will develop as the market requires them, but it can not happen without significant development of infrastructure and easy access. The Trans-Pennine Trail is linked to many of the case study sites and acts as both an aid to access but also as a focus for funding and sympathetic developments. Integration of socio-environmental projects with other regeneration initiatives will enhance their attractiveness and, because of this, be seen as funding opportunities in their own right. The evidence is clear that this is already happening in the Don catchment but there could be even better return for this input if the catchment was seen more holistically and even linked to adjoining, seemingly successful initiatives such as the Humberhead Levels *'Value in Wetness'* project. Alongside this there must be more active promotion of wetland sites that are robust enough to accept increased visitor usage. This is not as straightforward as may be apparent as many wetland areas are managed by small voluntary sector organisations that do not have the staff resources to interact with such levels of usage. Key to this is obviously allocation of resources, particularly revenue funding, which is not always easy to identify.

10.6 Future needs - a summary of the outcomes of the research - constraints and opportunities.

In general terms the outcomes of the research have suggested that there is a need for further investigation to be carried out. In the social sphere there is a need to develop policy on a wider scale within the catchment as a whole to provide guidance on recreational, tourism and educational themes which can be linked to nature conservation projects. Partial attempts to address some elements of this are already evident in the Humberhead Levels Initiative and the planning for the joint RSPB/Environment Agency 'necklace of wetland jewels' project in the Dearne Valley but a more integrated catchment approach may be beneficial.

Identifying site selection criteria, particularly in view of changing attitudes towards flood prevention schemes may be necessary. This seems self-evident for the lower catchment but may also require closer examination of upland land management in terms of delaying floodwaters on their journey downstream. Equally, in the upland areas changing agricultural practices and neglect of land may occur resulting both in conservation opportunities but also a potential biodiversity disaster where lack of vegetation management results in severely changed landscape and habitat character.

In more specific terms the research has identified areas that need closer attention and these are outlined in the following sections.

10.6.1 Policy context.

* It is very evident that there is a plethora of legislation and policy at various levels associated with the subject area, but the research has identified that there are gaps in the flow of communication. A particular priority would therefore be to find mechanisms by which better integration can be achieved between the variety of 'players' and the various sectors involved e.g. water resources, water quality, agriculture, flood management, fisheries, land use planning, recreation and biodiversity.

* Different organisations need to collaborate rather than compete for resources in a regional context. Equally, the larger individual organisations with multiple functions need to achieve greater internal co-ordination.

* In terms of biodiversity protection and enhancement any lack of success in project development cannot be solely attributed to lack of policy guidance.

* Significant policy development is occurring (such as the Water Framework Directive) alongside responses to events that possibly relate to climate change, and these are creating a strong link between water management and conservation targets, and particularly between floodplain initiatives and biodiversity targets.

* There is evidence of the need for projects to deliver multiple, cross-sector objectives.

* Most commentators agree that there is a need to view social, economic and environmental factors at the catchment level and to be able to cross administrative boundaries and funding competitiveness. This provides a common geographical basis based on natural features rather than political boundaries. Regional habitat and species Biodiversity Action Plans will influence site prioritisation. Development of conservation projects can then be viewed and identified in a regional context enabling priorities to be made for site selection in terms of location and habitat/species importance. These can be balanced by opportunities provided by other initiatives such as flood management schemes, reclamation of mineral extraction sites, remediation of mining subsidence, agricultural diversification and development related initiatives.

* Before individual site based projects are identified there is a need for important floodplains in the regions to be identified to protect and enhance their flood management, landscape and ecological significance and potential.

10.6.2 Funding issues.

* In the context of regionally identified projects there should be a regionally agreed approach to funding which particularly identifies stakeholders and partnerships and thus strengthens the desirability of bids.

* It is crucial to include landowners as key stakeholders in formulating site objectives and in the bidding process. Lack of control of land can prevent projects taking place but support from landowners may be dependent on a sympathetic view of farming culture and needs by conservation organisations involved. Issues of compensation for earnings lost may need to be taken into account.

* Such a strategic approach should also attempt to identify funding that provides a long-term management basis and can address problems of staffing and on-going maintenance/management.

* Long-term funding requires a cultural change within funding agencies which tend to look at project development rather than extending into project management and continuity.

* There is a need to influence policy which in turn can influence funding to emphasise the public benefits of farm diversification that manages in a way that is sympathetic to landscape and wildlife features.

* Economic and social features as part of, or influenced by, an environmental improvement project can be used in the bidding process to identify multiple-sector project objectives by providing a 'green' frame for regeneration and by promoting tourism, recreation and health benefits. In the planning system Section 106 agreements (such as for Blackburn Meadows nature reserve) can provide ideal opportunities to link environmental and social benefits into regeneration and development schemes.

* Careful integration of funding sources can provide leverage to enhance other funding sources, for instance with those sources that require match funding.

* National policy dictates that Environment Agency flood management schemes require biodiversity issues to be considered. The Agency's response to increasing flood events in part is based on a need to identify large areas of floodplains as flood retaining cells. If designed for over capacity then habitat creation schemes within them can be achieved.

* There is a need to recognise that acquiring project funding is increasingly a dedicated role.

* Changes in agricultural practices and changes in the mechanisms of agri-environment funding schemes may provide more diverse opportunities to manage, enhance and create wetland features.

* The core funding agencies that have been traditionally approached for environmental projects, such as the Countryside Agency and English Nature, are constrained by their inability to fund projects other than on a year by year basis. This gives no project

security and, if projects are abandoned because of this, it provides a negative public image.

10.6 3 Delivery mechanisms.

* Although the research has clearly identified the crucial role of a project champion in the majority of the case study projects it is not easy to find or 'create' such a person. They tend to be few in number and have had to overcome barriers of lack of confidence and skills. Future research may be directed to identifying the characteristics of what factors develop a project champion, what skills they need and what encouragement (in the form of training) do they require?

* In the early 1980s the then Countryside Commission developed the concept of Countryside Management Projects in urban fringe areas where a Project Officer could oversee enhanced conservation and recreation provision with a limited ability to overcome 'red tape'. Projects were often in multiple land ownership with equally multiple land use activity but experience would show that many of the projects were very successful. Promoting projects on a catchment basis is a similar, if larger, concept and the appointment of a Project Officer (backed by a multi-skilled team and an advisory/steering committee of key stakeholders) could provide a similar role.

* People need persuading that change can be beneficial and that projects will be viable. To assist this demonstration and/or pilot projects can be provided that build interest and can encourage word of mouth promotion.

* Plans for a multi-agency environmental centre at Potteric Carr could be developed into a centre of excellence providing advice, support, expertise and information.

* Regular meetings of stakeholders and interested parties are held through the *Value in Wetness* programme for the Humberhead Levels. This provides a similar function to the centre of excellence above but also allows an airing of views, the opportunity to network and to access innovatory developments. This process could be duplicated at catchment level or for other sub-catchments.

* A system of identifying and disseminating 'best practice' could be developed between practitioners, stakeholders and Project Officers.

* Partnerships between any combination of business interests, governmental agencies, local authorities and the voluntary sector can provide a more cohesive approach to product development. Individual members can often identify and access different sources of funding and grant aid, they can bring different skills and expertise and may well be influential in securing permissions for work to take place.

* Such partnerships provide confidence to landowners by providing expertise that can ensure successful achievement of often complex wetland developments.

BIBLIOGRAPHY.

Adams, L.W. (1991) Wildlife Reserves and Corridors: Habitat Patterns in the Urban Landscape. In Rieley, J.O. and Page, S.E. [Eds.](In Press) *Habitat Creation and Wildlife Conservation.* Packard. Chichester.

Adams, L.W. and Dove, L.E. (1989). *Wildlife Reserves and Corridors in the Urban Environment: A Guide to Ecological Landscape Planning and Resource Conservation.* National Institute for Urban Wildlife, Columbia, US.

Allaby, M. (1979). *Dictionary of the Environment.* The Macmillan Press. London.

Anon. (Undated [a]). *Water Quality – a Guide to Water Protection in England and Wales.* [Online] Department of the Environment, Transport and the Regions. London.
Available from: http://www.environment.detr.gov.uk/wqd/guide/water.htm [Accessed September, 2000].

Anon. (Undated [b]). *Discover European Wetlands: A Guide to Twelve Wetlands in the North Sea Region.* Halland County Administrative Board. Halmstad, Sweden.

Anon. (Undated [c]). *The Challenge of Integrating Environmental Requirements Into the Common Agricultural Policy.* [Online]. European Commission, Directorate of Agriculture, Environment and Rural Development, Brussels.
Available from: http://europa.eu.int/comm/agriculture/envir/report/en/concl_en/report.htm [Accessed July, 2002].

Anon. (Undated [d]). *Guidelines for Integrating Wetland Conservation and Wise Use into River Basin Management.* Ramsar Convention Bureau, Gland, Switzerland.
Available from: http://www.ramsar.org/key_guide_basin_e.htm [Accessed August, 2002].

Anon. (Undated [e]). *South Yorkshire Forest – background.* [Online] South Yorkshire Forest Partnership. Sheffield.
Available from: http://www.communityforest.org.uk/syforest/html/about.htm [Accessed November, 2000].

Anon. (Undated [f]). *River Corridors and Wetland Restoration.* [Online] United States Environmental Protection Agency, US.
Available from: http://www.epa.gov/owow/wetlands/restore/intro.htm [Accessed January, 1999].

Anon. (Undated [g]). *The Ramsar Convention's Resources on Wetland Restoration.* [Online] Ramsar Convention Bureau. Gland, Switzerland.
Available from: http://www.ramsar.org/strp_rest_index.htm [Accessed March, 2001].

Anon. (Undated [h]). *History of the ICPR and the Characteristics of the Rhine.*
[Online] International Commission for the Protection of the Rhine. Switzerland.
Available from: http://www.iksr.org/hw/icpr [Accessed August, 2003].

Anon. (Undated [i]). *WWF Danube-Carpathian Programme.* [Online] Worldwide Fund for Nature, Brussels.
Available from: http://www.panda.org/about_wwf/where_we_work/europe/where/danube_carpathian
[Accessed August, 2003].

Anon. (Undated [j]). Rother Valley Country Park. [Online] Rotherham MBC.
Available from: http://www.rothervalleycountrypark.co.uk [Accessed August, 2003].

Anon. (1989). *The Upper Don Tributaries Study – Opportunities for the Joint Management of Land and Water in the Upper Catchment Area of the River Don.* Peak Park Joint Planning Board. Bakewell, Derbyshire.

Anon. (1991). *Protected Areas Programme: World Heritage Sites: Danube Delta Biosphere Reserve.* [Online] UNEP World Conservation Monitoring Centre, Cambridge.
Available from: http://www.wcmc.org.uk/protected_areas/data/wh/danubed.html [Accessed August, 2003].

Anon. (1993a). *Countryside Survey, 1990.* Department of the Environment. HMSO. London.

Anon. (1993b). *Natural Areas: Setting Nature Conservation Objectives; a Consultation Paper.* English Nature. Peterborough.

Anon. (1994a). *Biodiversity: The UK Action Plan.* Department of the Environment. HMSO. London.

Anon. (1994b). *Water Level Management Plans – a Procedural Guide for Operating Authorities.* MAFF. London.

Anon. (1994c). *River Rother Wildlife Strategy.* Derbyshire County Council, Sheffield City Council, Rotherham Borough Council, Chesterfield Borough Council, North East Derbyshire District Council and Bolsover Council.

Anon. (1995a). *Biodiversity: The UK Steering Group report, Action Plans.* **Vol. 2.** Department of the Environment. HMSO. London.

Anon. (1995b).*Woodhouse Washlands Nature Reserve: A Feasibility Study.* Sheffield Centre for Ecology and Environmental Management.

Anon. (1997). *Public Attitudes to the Countryside.* Countryside Commission, Northampton.

Anon. (1997). *Local Environment Agency Plan: South Yorkshire and North East Derbyshire [Consultation Report].* Environment Agency, Leeds.

Anon. (1999a). *Participatory Techniques for Land Use Planning.* [Online]. EU LIFE Project on Wise Use of Flood plains. RSPB, Sandy, Bedfordshire.
Available from http://www.flood plains.org [Accessed August, 2001].

Anon. (1999b). *Identification of Techniques for Appraisal of Flood plain Wetlands.* [Online]. EU LIFE Project on Wise Use of Flood plains. RSPB, Sandy, Bedfordshire.
Available from http://www.flood plains.org [Accessed August, 2001].

Anon. (2000a). *The Common Agricultural Policy: 1999 Review.* Office for Official Publications of the European Communities, Luxembourg.

Anon. (2000b). *Implementing the EU Water Framework Directive: a Seminar on Good Practice in River Basin Planning.* Worldwide Fund for Nature, European Freshwater Programme, Brussels.
Available from: http://www.panda.org/europe/freshwater [Accessed September, 2001].

Anon. (2000c). *Implementing the EU Water Framework Directive: a Seminar on Water and Agriculture.* Worldwide Fund for Nature, European Freshwater Programme, Brussels.
Available from: http://www.panda.org/europe/freshwater [Accessed April, 2001].

Anon. (2000d). *Implementing the EU Water Framework Directive: a Seminar on the Role of Wetlands in River Basin Management.* Worldwide Fund for Nature, European Freshwater Programme, Brussels.
Available from: http://www.panda.org/europe/freshwater [Accessed April, 2001].

Anon. (2000e). *The South Yorkshire Forest Plan.* South Yorkshire Forest Partnership. Sheffield.

Anon. (2000f). Saving Natural Paradises in Europe. In *Danube Water*, **2**, 2000. ICPDR.

Anon. (2001a). *Elements of Good Practice in Integrated River Basin Management: A Practical Resource for Implementing the EU Water Framework Directive.* Worldwide Fund for Nature, European Freshwater Programme, Brussels.

Anon. (2001b). *Water and Wetland Index: Assessment of 16 European Countries.* Worldwide Fund for Nature, European Freshwater Programme, Brussels.
Available from: http://www.panda.org/europe/freshwater [Accessed April, 2001].

Anon. (2002a). *Natural Heritage Futures – Fresh Waters.* Scottish Natural Heritage. Perth, Scotland.

Anon. (2002b). *The Water Framework Directive: Guiding Principles on the Technical Requirements.* Environment Agency, Bristol.

Anon. (2002c). *Regional Quality of Life Counts, 2001.* Department for Environment, Food and Rural Affairs, London.

Anon. (2002d). *Directing the Flow.* Department for Environment, Food and Rural Affairs, London.

Audet, J. and d'Amboise, G. (2001). The Multi-site Study: An Innovative Research Methodology. In *The Qualitative Report*, Vol. 6, No. 2.

Avery, M., Bourn. N., Davis, R., Everitt, J., Halahan, R., Harper, M., Parsons, M., Phillips, M., Sands, T., Williams, G. and Wynde, R. (2001). *Biodiversity Counts: Delivering a Better Quality of Life.* Biodiversity Challenge: Butterfly Conservation, Friends of the Earth, Plantlife, The RSPB, The Wildlife Trusts and WWF-UK.

Bailey, A.D. (1998). Flood plains and Agriculture. In **Bailey, R.G., Jose, P.V. and Sherwood, B.R. [Eds.]**(1998). *United Kingdom Flood plains.* Westbury Academic and Scientific Publishing, Otley, West Yorkshire.

Bailey, R.G., Jose, P.V. and Sherwood, B.R. [Eds.](1998). *United Kingdom Flood plains*. Westbury Academic and Scientific Publishing, Otley, West Yorkshire.

Baines, J.C. (1989). Choices in Habitat Re-creation. In **Buckley, G.P. [Ed.]** (1989). *Biological Habitat Reconstruction*. Belhaven Press, London.

Balmford, A., Bruner, A., Cooper, P., Costanza, R., Farber, S., Green, R.E., Jenkins, M., Jefferiss, P., Jessamy, J., Munro, K., Myers, N., Naeem, S., Paavola, J., Rayment, M., Rosendo, S., Roughgarden, J., Trumper, K. and Turner, R.K. (2002). Economic Reasons for Conserving Wild Nature. In *Science* **297 (5583)**: 950 - 953. American Association for the Advancement of Science, Washington DC, US.

Barbier, E.B., Acreman, M.C. and Knowler, D. (1996). *Economic Valuation of Wetlands: A Guide for Policy Makers and planners*. Ramsar Convention Bureau, Gland, Switzerland.

Barbier, E.B., Burgess, J. and Folke, C. (1994). *Paradise Lost? - The Ecological Economics of Biodiversity*. Earthscan Publications, London.

Barker, G. (1984). Urban Nature Conservation Abroad. In *The Planner,* **70** (6), p21.

Barter, S. (2002). *Fischler's Farmyard Revolution.* [Online]. BBC News.
Available from: http://news.bbc.co.uk [Accessed July, 2002].

Barth, F. (2000). *The Importance of Wetlands for Delivering the Environmental Objectives of the Water Framework Directive*. Worldwide Fund for Nature, European Freshwater Programme, Brussels.
Available from: http://www.wwfreshwater.org/seminars/sem2/barth.htm [Accessed April, 2001].

Beard, C. and Parr, J. (1999). *Research Methodology and the Art of Investigation*. Unpublished summary paper of a post graduate dissertation workshop. Sheffield Hallam University, UK.

Becker, H.S. (1965). Review of P.E. Hammond's - Sociologists at Work. In *American Sociological Review*, **30**, 602 - 3.

Bell, J. (1997). *Doing Your Research Project: A Guide for First-time Researchers in Education and Social Science.* (2nd Edition). Open University, UK.

Belshaw, T. (2000). Newspaper article - *So what would John Ruskin have made of the latest exhibition at the gallery which proudly bears his name?* In Sheffield Star newspaper, 16 February, 2000. Sheffield Newspapers. Sheffield.

Bennett, A.F. (1998). *Linkages in the Landscape: The Role of Corridors and Connectivity in Wildlife Conservation.* IUCN, Gland, Switzerland.

Berry, P. (2002). Climate Change – What Could 2050 Look Like. In, *ENACT*, vol.10, **1**: 13 –16. English Nature. Peterborough.

Bibby, C. and Lunn, J. (1982). Conservation of Reedbeds and Their Avifauna in England and Wales. In *Biological Conservation* **23**: 167 – 186. UK.

Bibby, C., Housden, S., Porter, R., and Thomas, G. (1989). *A Conservation Strategy for Birds*. (unpublished report). RSPB. Sandy, Bedfordshire.

Blasco, D. (1996). Preface in **Barbier, E.B., Acreman, M.C. and Knowler, D.** (1996). *Economic Valuation of Wetlands: A Guide for Policy Makers and Planners*. Ramsar Convention Bureau, Gland, Switzerland.

Blaxter, L., Hughes, C. and Tight, M. (1996). *How to Research*. Open University Press, Buckingham

Bocker, R. (1991). Nature Conservation in Cities: An Introduction to Urban Habitats and Their Protection. In **Rieley, J.O. and Page, S.E. [Eds.]**(In Press) *Habitat Creation and Wildlife Conservation*. Packard. Chichester.

Bownes, J.S., Riley, T., Rotherham, I.D. and Vincent, S.M. (1991). *Sheffield's Nature Conservation Strategy.* Sheffield City Council.

Box, J.D. (1986). The Conservation of Post-industrial Landscapes. In **Rieley, J.O. and Page, S.E. [Eds.]**(In Press) *Habitat Creation and Wildlife Conservation*. Packard. Chichester.

Box, J.D. (1993). Conservation or Greening: The Challenge of Post-industrial Landscapes. In *British Wildlife* **4(5)**, 273 – 279.

Bradshaw, A.D. and Chadwick, M.J. (1980). *The Restoration of Land.* Blackwell. Oxford.

Buckley, G.P. [Ed.] (1989). *Biological Habitat Reconstruction.* Belhaven Press, London.

Burgess, N.D. and Evans, E. (1989). Management of Reedbeds. In *RSPB Conservation Review*, **3.** RSPB, Sandy, Bedfordshire.

Burgess, J. and Gold, J. [Eds.] (1982). *Valued Environments.* George Allen and Unwin Ltd. London.

Burgess, J. and Gold, J. (1982). On the Significance of Valued Environments. In **Burgess, J. and Gold, J. [Eds.]** (1982). *Valued Environments.* George Allen and Unwin Ltd. London.

Burgess, J., Harrison, C. and Limb, M. (1988). People, Parks and the Urban Green: A Study of Popular Menaings and Values for Open Spaces in the City. In *Urban Studies,* **25**, 455 - 473.

Burns, R.B. (2000). *Introduction to Research Methods (4th Edition).* Sage. London.

Burton, A. (1982). *The Changing River: An Account of Some British Waters and Their History.* Victor Gollancz Ltd., London.

Cartwright, G. (1986). *Wildlife and Leisure in the Lower Don Valley.* Sheffield City Council, Museums Department.

Cartwright, G.A. (1998) *Urban Nature Reserves - Don't Forget Homo sapiens.* In Journal of Practical Ecology and Conservation, Vol. **2**, No 1. Wildtrack Publishing, Sheffield.

Cartwright, G.A. (2000) *I Did it My Way? - The Need For Project Champions.* Conference Presentation at the South Yorkshire Biodiversity conference held in Sheffield.

Cartwright, G.A. and Watts, R. (2000) *Environmental Concerns in Integrated Redevelopment of Derelict Industrial Areas : A Case Study of Sheffield's Former Industrial Heartland.* Poster presentation at the SER2000 international conference of the Society for Ecological Restoration, held in Liverpool.

Cartwright, G.A. and Watts, R. (2000) *Sustainable Sewage: Restoration of Floodplain Landscapes on Derelict Sewage Works.* Poster presentation at the SER2000 international conference of the Society for Ecological Restoration, held in Liverpool.

Cartwright, G., Egan, D. and Senior, C. (1998) *Don and Dearne Green Corridors: Strategic Information Review: Paper 1: Social Conditions ands Community Aspirations*; *Paper 2: Economic Needs, Trends and Potential*; and *Paper 3: State of the Environment.* Sheffield Hallam University, Sheffield.

Chincea, I. (2000). *Sustainable Use of the Danube's Natural Resources Through the Creation of the Biosphere Reserve: "Iron Gates – Djerdap".* [Online]. Available from: http://danubedita.tripod.com/library/2000chincea.htm [Accessed August, 2003].

Clark, J. and Burgess, J. (1999). Evaluating Methodologies for Wetlands and Buffer Zones: A North Devon Case Study (Part 2). In *Ecological/Economic Analysis of Wetland: Functions, Values and Dynamics* (ECOWET). London.

Coalfield Communities Campaign. (1995). *Poisoned legacy: Water Pollution from Abandoned Mines.* Coalfield Communities Campaign, Barnsley.

Commission of the European Communities. (1999). *Directions Towards Sustainable Agriculture.* Communication to the Economic and Social Committee and the Committee of the Regions of the Council of the European Parliament. Brussels.

Costanza, R. (1991). *Ecological Economics: The Science and Management of Sustainability.* Columbia University Press. New York, USA.

Countryside Agency. (2000). *Research Note CRN 5: Integrating the Environment into the CAP.* Countryside Agency, Cheltenham.

Countryside Agency. (Undated). Humberhead Levels: Value in Wetness. [Online]. Countryside Agency, Cheltenham.
Available from: http://www.ruralnet.org.uk/humberhead/contents.htm [Accessed October, 2000].

Countryside Commission. (1997). *Don and Dearne Green Corridors - 2020 Vision for the Don and Dearne: Strategic Information Review - Brief for Consultants.* Unpublished consultancy brief. Countryside Commission, Leeds.

Cox, M., Straker, V. and Taylor, D. [Eds.] (1994). *Proceedings of the International Conference - Wetlands: Archaeology and Nature Conservation*. HMSO. Bristol.

Cresswell, J.W. (1998). *Qualitative Inquiry and Research Design: Choosing Among Five Traditions.* Sage, California, US.

Crossley, D. [Ed.] (1989). *Water Power on the Sheffield Rivers*. University of Sheffield and Sheffield Trades Historical Society, Sheffield.

Daily, G.C. and Ellison, K. (2002). *The New Economy of Nature: The Quest to Make Conservation Profitable.* Shearwater (Island Press), Washington DC, US.

David, D. (1988). Developments Under the Ramsar Convention. In **Hook, D., McKee, W., Smith, A., Gregory, V., Burrell, V., DeVoe, M., Sojka, R., Gilbert, S., Banks, R., Stolzy, L., Brooks, C., Matthews, T. and Shear, T. [Eds.]**(1988). *The Ecology and Management of Wetlands Volume 2: Management, Use and Value of Wetlands.* Croom Helm. Kent.

Davis, T.J. (1993). *Towards the Wise Use of Wetlands*. Ramsar Convention Bureau. Gland, Switzerland.

Dawson, D. (1994) *Are Habitat Corridors Conduits for Animals and Plants in a Fragmented Landscape?* English Nature Research Report No. 94. English Nature, Peterborough

Day, J.C.U. and Wilson, J. (1978). Breeding Bitterns in Britain. In *British Birds* **71**: 285 – 300. UK.

Debinski, D.M. and Holt, R.D. (2000) A Survey and Overview of Habitat Fragmentation Experiments. In *Conservation Biology*, **14**, No. 2. pp 342 - 355.

Department of the Environment, Food and Rural Affairs. (2002). *The Government's Strategic Review of Diffuse Water Pollution from Agriculture in England Paper 1: Agriculture and Water: A Diffuse Pollution Review.* Available from: http://www.defra.gov.uk/environment/water/dwpa/reports/dwp Accessed December, 2002.

Department of the Environment, Transport and the Regions [DETR]. (2001). *Planning Policy Guidance PPG 25: Development and Flood Risk* [draft]. DETR, London.

Denny, P. (1994). Benefits and Priorities for Wetland Conservation: The Case for National Wetland Conservation Strategies. In **Cox, M., Straker, V. and Taylor, D. [Eds.]** (1994). *Proceedings of the International Conference - Wetlands: Archaeology and Nature Conservation*. HMSO. Bristol.

Denscombe, M. (1998). *The Good Research Guide for Small-scale Social Research Projects*. Open University, UK.

DMBC. (2002). *The Doncaster Development Direction. 3D. A White Paper.* Doncaster Metropolitan Borough Council. July 2002.

Dugan, P. J. (1988). The Importance of Rural Communities in Wetlands Conservation and Development. In **Hook, D., McKee, W., Smith, A., Gregory, V., Burrell, V., DeVoe, M., Sojka, R., Gilbert, S., Banks, R., Stolzy, L., Brooks, C., Matthews, T. and Shear, T. [Eds.]**(1988). *The Ecology and Management of Wetlands Volume 2: Management, Use and Value of Wetlands*. Croom Helm. Kent.

Doyle, R. (1997). *Freshwater Fish at Risk in the U.S.* [Online, December, 1997]. Scientific American. USA. Available from: http://www.sciam.com/1297issue/1297scicit7.htm [Accessed October, 2000].

Dyduch-Falniowska, A. (1998). Effects of Economic Transformation on Ecological Corridors. In *European Nature*, Issue 1, November, 1998. European Centre for Nature Conservation, Tilburg, Netherlands.

Easterby-Smith, M., Thorpe, R. and Lowe, A. (1991). *Management Research: An Introduction.* Sage Publications, London.

Edwards, A. (1996). Salmon in the Don - Who Pays? In **Edwards, A. [Ed.]** (1996). *Proceedings of a Conference - Towards a Sustainable Future for the River Don*. National Rivers Authority. Sheffield.

Edwards, A. (1997). *Local Environment Agency Plan - South Yorkshire and North Derbyshire (Consultation Report)*. Environment Agency. Leeds.

Edwards, A. (1998). *Local Environment Agency Plan - South Yorkshire and North Derbyshire*. Environment Agency. Leeds.

English Nature. (1994). *Action for Reedbed Birds.* EN Action Plan. Peterborough.

English Nature. (1997). *Wildlife and Fresh Water: An Agenda for Sustainable Management.* EN, Peterborough.
English Nature. (2001). *Sustainable Flood Defence: The Case for Washlands.* English Nature Research Report No. 406. English Nature, Peterborough.

English Nature. (2002). Position Statement: Managing Flood plains to Reduce Flood Risk and Enhance Biodiversity.
Available from: http://www.english-nature.co.uk/news/statement.asp?Id=35&K [Accessed December, 2002].

Environment Agency. (undated [a]). *Somerset Levels and Moors – Wise Use of Wetlands.* [Online]. UK.
Available from: http://www.somerset.gov.uk/levels/WiseUse.htm [Accessed February, 2000].

Environment Agency. (undated [b]). Somerset Levels and Moors Water Level Management – Strategic Review. [Online]. *UK.*
Available from: http://www.somerset.gov.uk/levels/Reserve/EAwetstr.htm [Accessed February, 2000].

Environment Agency. (undated [c]). *Somerset Levels and Moors – Wise Use Guidelines.* [Online]. UK.
Available from: http://www.somerset.gov.uk/levels/Wiseguid.htm [Accessed February, 2000].

Environment Agency. (undated [d]). *The River Wandle, Beverley Brook, Hogsmill – The Catchment Management Process, an Introduction.* [Online]. UK.
Available from: http://www.geo.ed.ac.uk:81/~envag/manage.htm [Accessed May, 2000].

Environment Agency. (undated [e]). *Policy and Practice for the Protection of Flood plains.* [Online]. UK.
Available from: http://www.environment-agency.gov.uk/flood/pdf/flood.pdf [Accessed February, 2001].

Environment Agency. (1996). *Environmental Assessment of Selected Abandoned Minewaters in the North East Region.* Environment Agency, Leeds.

Environment Agency. (1997). *Local Environment Agency Plan, South Yorkshire and North East Derbyshire: Consultation Report.* Environment Agency, Leeds.

Environment Agency. (1998 [a]). *Local Environment Agency Plan, Wye Area: Consultation Report.* Environment Agency Wales.

Environment Agency. (1998 [b]). *Local Environment Agency Plan, South Yorkshire and North East Derbyshire.* Environment Agency, Leeds.

Environment Agency. (2001). *Lessons Learned: Autumn 2000 Floods.* Environment Agency, Bristol.

Environment Agency. (2002). *River Trent Strategy: A Flood Management Strategy for the Non-tidal River Trent Corridor.* Environment Agency, West Midlands.

European Environment Agency [EEA]. (2001). *Sustainable Water Use in Europe, Part 3: Extreme Hydrological Events - Floods and Droughts.* EEA, Copenhagen.

Everard. M. (1997). Development of a British Wetland Strategy. In *Aquatic Conservation – Marine and Freshwater Ecosystems*, **Vol.7**, No.3, 223 – 238. UK.

Everett, S. (2000). Conservation News – Inquiry into UK Biodiversity. In *British Wildlife*, **Vol. 12**, No. 1. p63. Hampshire.

Everett, S. (2000). Conservation News – Proposed New Special Areas of Conservation. In *British Wildlife*, **Vol. 12**, No. 1. p64. Hampshire.

Fay, F. (Undated). Impact of Agri-environment Measures. [Online]. European Commission, Directorate of Agriculture and Environment, Brussels.
Available from: http://europa.eu.int/comm/agriculture/envir/report/en/2078_en/report.htm [Accessed July, 2002].

Firth, C. (1997). *Domesday to the Dawn of the New Millennium: 100 Years of the Don Fishery.* Environment Agency, Leeds.

Flood Hazard Research Centre. (Undated). *Public Perception of Rivers and River Restoration.* [Online]. Middlesex University, UK.
Available from: http://alpha1.mdx.ac.uk/www/gem/resthem4.htm [Accessed October, 1999].

Fog, J. and Lampio, T. (1982). When to Manage. In Scott, D.A. [Ed.] (1982). *Managing Wetlands and Their Birds*. International Waterfowl Research Bureau. Slimbridge, UK.

Foulkes, I. (2001). *Rhine on Path to Recovery.* Online Press report. BBC World Service, London. Available from: http://news.bbc.co.uk/l/hi/world/europe [Accessed August, 2003].

Fowler, S., Jose, P. V. and Smith, K. (1998). Wet Grasslands for the Millennium. In *RSPB Conservation Review*, **No. 12**. RSPB. Sandy, Bedfordshire.

Gardiner, J.L. (1998). Flood plain Management in the United Kingdom. In **Bailey, R.G., Jose, P.V. and Sherwood, B.R. [Eds.]** (1998). *United Kingdom Flood plains*. Westbury Academic and Scientific Publishing, Otley, West Yorkshire.

Gardner, W.H. and Mackenzie, N.H. [Eds.] (1967). *The Poems of Gerard Manley Hopkins*. Oxford University Press, London.

Giblett, R. (1996). *Post-modern Wetlands - Culture, History, Ecology*. Edinburgh University Press, Edinburgh.

Gilbert, O. (1989). *The Ecology of Urban Habitats*. Chapman and Hall, London.

Gilbert, O. (1992). The Ecology of an Urban River. In *British Wildlife*, **3** (3), 129 - 36.

Gilbert, O. and Anderson, P. (1998). *Habitat Creation and Repair*. Oxford University Press, Oxford.

Gill, J. and Johnson, P. (1991). *Research Methods for Managers*. Paul Chapman Publishing, London.

Goudie. A. (1981). *The Human Impact on the Natural Environment*. Blackwell. Oxford.

Goudie. A. and Viles. H. (1997). *The Earth Transformed: An Introduction to Human Impacts on the Environment.* Blackwell, Oxford.

Green, F.H.W. (1973). Aspects of the Changing Environment: Some Factors Affecting the Aquatic Environment in Recent Years. In *Journal of Environmental Management*, **1**, 377 - 391.

Green, B. (1996). *Countryside Conservation* [3rd Edition]. E. & F.N. Spon. London.

Griffiths, P. (1995). A Changing Sense of Place: Sheffield's Lower Don Valley. In *Convocation News*, **17,** pp 6 – 7.

Griffiths, P. (1999). *The Five Weirs Walk; Sheffield East End History Trail 3*. The Hallamshire Press, Sheffield.

Hakim, C. (1987). *Research Design: Strategies and Choices in the Design of Social Research.* Allen and Unwin, London.

Hanley, N.D. (1989). *Economics and the Environment.* Stirling Economics Teaching Paper no. 29. Department of Economics, University of Stirling. Scotland.

Harley, D.C. and Hanley, N.D. (1989). *Economics Benefit Estimates for Nature Reserves: Methods and Results.* Stirling Economics Teaching Paper no. 89/6. Department of Economics, University of Stirling. Scotland.

Harrison, C., Burgess, J., Millward, A. and Dawe, G. (1995) *Accessible Natural Greenspace in Towns and Cities: A Review of Appropriate Size and Distance Criteria.* English Nature Research Report No. 153. English Nature, Peterborough.

Hart, C. (1998). *Doing a Literature Review: Releasing the Social Science Research Imagination*. Sage, London.

Haslam, S. M. (1973). The Management of British Wetlands. I. Economic and Amenity Use. In *Journal of Environmental Management*. **I**, 303 - 320.

Haslam, S. M. (1973). The Management of British Wetlands. II. Conservation. In *Journal of Environmental Management.* **I**, 345 - 361.

Hawke, C. J. and Jose P. V. (1995). *Reedbed Management for Commercial and Wildlife Interests.* RSPB. Sandy, Bedfordshire.

Heliotis, F., Vellidis, G., Bandacu, D. and Pringle, C. (1994). The Danube Delta: Historical Wetland Drainage and Potential for Restoration. In **Mitsch, W.J.** (1994). *Global Wetlands: Old World and New*. Elsevier Science, Amsterdam.

Hey, D. (1972). *The Rural Metalworkers of the Sheffield Region: A Study of Rural Industry before the Industrial Revolution*. Department of English Local History, Occasional Papers, Second Series, No. 5. Leicester University Press.
Hey, D. (1979). *The Making of South Yorkshire*. Carnegie Publishing, Lancaster.

Hey, D. (1998). *A History of Sheffield*. Moorland Publishing, Derbyshire.

Hey, D., Olive, M. and Liddament, M. (1997). *Forging the Valley*. Sheffield Academic Press, Sheffield.

Hirsch, A. (1988). Wetlands Ranking – An Innovative Approach to Wetland Regulation. In **Hook, D., McKee, W., Smith, A., Gregory, V., Burrell, V., DeVoe, M., Sojka, R., Gilbert, S., Banks, R., Stolzy, L., Brooks, C., Matthews, T. and Shear, T. [Eds.]** (1988). *The Ecology and Management of Wetlands Volume 2: Management, Use and Value of Wetlands*. Croom Helm. Kent.

Hogan, D. and Maltby, E. (2002). *Report on the Benefits of Washland Creation Along the Lower Don*. Wetlands Ecosystems Research Group, Virginia Water, Surrey.

Hook, D., McKee, W., Smith, A., Gregory, V., Burrell, V., DeVoe, M., Sojka, R., Gilbert, S., Banks, R., Stolzy, L., Brooks, C., Matthews, T. and Shear, T. [Eds]. (1988). *The Ecology and Management of Wetlands Volume 2: Management, Use and Value of Wetlands*. Croom Helm. Kent.

Hoskins, W.G. (1955). *The Making of the English Landscape*. Hodder and Stoughton. London.

Howe, J. and White, I. (2002). Farming, Flooding and Pollution. In *ECOS* Vol. 23, Issue (2)

Hughes, J. M. R. (1992). The Use and Abuse of Wetlands. In **Mannion, A. M. and Bowlby, S. R. [Eds.]** (1992). *Environmental Issues in the 1990s*, John Wiley and Sons Ltd. Chichester.

Hughes, T. (1983). *River*. Faber and Faber, London.

Hutchings, D. (1999). *Integrated River Basin Management and its Importance for the Future Well-being of Wales*. Environment Agency. UK.
Available from: http://www.environment-agency.gov.uk/modules/MOD38.66.htm [Accessed April, 2000].

Hutchings, D. (1999). *Managing Our Water Resources*. Environment Agency. UK.
Available from: http://www.environment-agency.gov.uk/modules/MOD38.67.htm [Accessed April, 2000].

ICPDR. (2000). *Joint Action Programme for the Danube River Basin: January 2001 – December 2005*. International Committee for the Protection of the Danube River, Vienna.

Institute for Systems, Informatics and Safety. (undated). *SHYLOC - About Wetlands* [Online]. Joint Research Centre, European Commission. Belgium.
Available from: http://poplar.sti.jrc.it/public/iain/shyloc/medwet/medwet.htm [Accessed October, 1999].

Jarvis, P.J. (1990). Urban Cats as Pests and Pets. In *Environmental Conservation* **17** (2), 169 - 171.

Jones, M. (1993). *Sheffield's Woodland Heritage [2nd Edition]*. Green Tree Publications.

Jones, M. [Ed.] (1999). Aspects of Rotherham [3]. Wharncliffe Publishing, Sheffield.

Jones, M. (2000). *The Making of the South Yorkshire Landscape*. Wharncliffe Publishing, Barnsley.

Jones, T.A. and Hughes, J.M.R. (1993). Wetland Inventories and Wetland Loss Studies: A European Perspective. In **Moser, M., Prentice, R.C. and van Vessem, J. [Eds.]** *Waterfowl and Wetland Conservation in the 1990s*. IWRB Special Publication No.26. IWRB. Slimbridge, Gloucestershire.

Jose, P.V. (2000). *Habitat Restoration for the Bittern, Botaurus stellaris, in the United Kingdom*. In Volume of Abstracts from the International Conference of the Society for Ecological Restoration, 2000, Liverpool, UK.

Kendle, T. and Forbes, S. (1997). *Urban Nature Conservation*. E. & F.N. Spon, London.

Lawler, E.E., Mohrman, A.M., Ledford, G.E. and Cummings, T.G. (1985). *Doing Research That is useful for Theory and Practice*. Jossey Bass, San Francisco, US.

Lethier, H. (1993). In Pursuit of the Wise Use of Wetlands. In Davis, T.J. (1993). *Towards the Wise Use of Wetlands*. Ramsar Convention Bureau. Gland, Switzerland.

Lowe, J. and Lewis, D. (1980). *The Economics of Environmental Management.* Philip Allan Publishers. Oxford.

Lunn, J. (2000). *Ecological and Nature Conservation Aspects of Land Affected by Mining in the Yorkshire Coalfield.* Unpublished thesis for the degree of M. Phil. Sheffield Hallam University. Sheffield.

Lunn, J., Rotherham, I.D. and Spode, F. (2000).

Mabey, R. (1980). *The Common Ground.* Hutchinson. London.

MacArthur, R.H. and Wilson, E.O. (1967). *The Theory of Island Biogeography.* Monographs in Population Biology 1. Princetown University Press, Princetown, US.

Macauley Land Use Research Institute, Arkleton Centre for Rural Development Research and the Scottish Agricultural College. (2002*). Local Economic Linkages and the Natural Heritage.*
Available from: http://www.snh.org.uk/pdfs/strategy/rural/Final_0102.pdf [Accessed May, 2002].

Machan, P. (1999). *John Watts, Lambert Street: A Surviving Sheffield Firm With Over 200 Years' History.* **In Jones, M. [Ed.]** (1999). Aspects of Rotherham [3]. Wharncliffe Publishing, Sheffield.

Mackay, A. (2002). *The Health, Social and Environmental Benefits of Open-air Recreation.*
Available from: http://www.snh.org.uk/pdfs/access/rs-spbn.pdf [Accessed April, 2002].

Madgwick, J. (2000). Proposals for Strengthening EU Support for Flood Plain Management. In **Worldwide Fund for Nature.** (2000). *Implementing the EU Water Framework Directive: A Seminar Series on Water - Seminar 2: The Role of Wetlands in River Basin Management.* WWF Europe, Brussels.
Available from: http://www.panda.org/downloads/europe/sem-2proc.pdf [Accessed July, 2002].

Mafabi, P. and Taylor, A.R.D. (1993). The National Wetlands Programme, Uganda. In **Davis, T.J.** (1993). *Towards the Wise Use of Wetlands.* Ramsar Convention Bureau. Gland, Switzerland.

Maltby, E. (1986). *Waterlogged Wealth.* International Institute for Environment and Development. London.

Maltby, E., McInnes, R.J., Hutchin, M.G. and Hogan, D.V. (1998). Assessment of Wetland Functioning in the River Marginal Environment: Recent Scientific Progress and Future Priorities. In **Bailey, R.G., Jose, P.V. and Sherwood, B.R. [Eds.]** (1998). *United Kingdom Flood plains.* Westbury Academic and Scientific Publishing, Otley, West Yorkshire.

Maltby, E. and Blackwell, M. (1999). Evaluating Methodologies for Wetlands and Buffer Zones: a North Devon Case Study (Part 1). In *Ecological/Economic Analysis of Wetland: Functions, Values and Dynamics* (ECOWET). London.

Mannion, A.M. and Bowlby, S.R. (Eds). (1992). *Environmental Issues in the 1990s*, John Wiley and Sons Ltd. Chichester.

Martindale, R.K. (2000). *Restoration of Riverine Environments Through Integrated Catchment Management.* In Volume of Abstracts from the International Conference of the Society for Ecological Restoration, 2000, Liverpool, UK.

Mason, C.F. (1996). *Biology of Freshwater Pollution (3rd Edition),* Longman Group UK Ltd. Essex.

Mason, J. (1996) *Qualitative Researching.* Sage, London.

McClarence, S. (1988). *Sheffield Walkabout.* Sheffield City Libraries, Sheffield.

Merritt, A. (1994). *Industry, Wildlife and Wetlands – A Manual of Principles and Practices,* The Wildfowl and Wetlands Trust. Gloucester.

Merton, R.K., Fiske, M. and Kendall, P.L. (1956) *The Focused Interview.* Free Press, Illinois, US. cited in **Robson** (2002).

Middleton, P. (2000). The Wildlife Significance of a Former Colliery Site in Yorkshire. In, *British Wildlife*, **11**, 333-339.

Miles, B. and Huberman, A.M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook.* (2nd Edition). Sage, California, US.

Mitchell, R.D. (1996a). *Yorkshire Wildlife Trust Potteric Carr Nature Reserve: Rehabilitation of Reed Fen at Willow Triangle.* Unpublished Report. Yorkshire Wildlife Trust, York.

Mitchell, R.D. (1996b). *Yorkshire Wildlife Trust Potteric Carr Nature Reserve: Future Role and Funding: Briefing Note.* Unpublished Report. Yorkshire Wildlife Trust, York.

Mitsch, W.J. and Gosselink, J.G. (1986). *Wetlands*. Van Nostrand Reinhold. New York.

Mitsch, W.J. (1994). The Nonpoint Source Pollution Control Function of Natural and Constructed Riparian Wetlands. In **Mitsch, W.J. [Ed.]** (1994). *Global Wetlands: Old World and New*. Elsevier, New York, US.

Morris, J., Mills, J., Burton, R., Hall, J.R., Dunderdale, J., Gowing, D., Gilbert, J.C. and Spoor, G. (1997). *Wet Fens for the Future: A Study of the Economic, Social and Soil Management of Creating New Wetlands in Fenland.* Cranfield University, Bedford.

Morse, J.M. (2000). Determining Sample Size. In *Qualitative Health Research*, **10**, 3 - 5. cited in Robson (2002).

Moser, M., Prentice, C. and Frazier, S. (1996). *A Global Overview of Wetland Loss and Degradation.* Ramsar Convention Bureau. Gland, Switzerland.
Available from: http://www.ramsar.org/about_wetland_loss.htm [Accessed March, 2001].

Moser, M. (2000). *Wetland Status and Trends: The Case for Rehabilitation and Restoration of Naturally Functioning Wetlands*. Worldwide Fund for Nature, European Freshwater Programme, Brussels.
Available from: http://www.wwfreshwater.org/seminars/sem2/moser.htm [Accessed April, 2001].

Moss, B. (1998). *Ecology of Fresh Waters - Man and Medium, Past to Future. [3rd Edition]*. Blackwell Science Ltd. Oxford.

Moss, M. (1995). *Countryside Recreation Resources and Principles for a Recreation Strategy for the River Don, South Yorkshire, England*. Sheffield, UK. Unpublished postgraduate dissertation, School of Leisure and Food Management, Sheffield Hallam University.

Muir, R. and Muir, N. (1986). *Rivers of Britain*. Book Club Associates. Exeter.

National Rivers Authority. (1994). *Regional Water Resources Strategy – Northumbria and Yorkshire*. NRA. Leeds.

National Rivers Authority. (1995). *Rivers Don, Rother and Dearne Catchment Management Plan: Action Plan.* NRA. Leeds.

National Rivers Authority. (Undated). *River Don Fact File.* NRA. Leeds.

National Rivers Authority. (Undated). *River Pollution from Farms in England.* (Online).
Available from: http://www.gtnet.gov.uk/nao/9495235.htm [Accessed July, 2000].

National Trust. (2001). *Valuing our Environment- The Economic Impact of the Environment of Wales.*
Available from: http://www.nationaltrust.org.uk/main/conservation/valuing_environment.html [Accessed: December 2001].

Nature Conservancy Council. (1987). *Planning for Wildlife in Metropolitan Areas*. NCC. Peterborough.

Neuman, W.L. (1994). *Social Research Methods: Qualitative and Quantitative Approaches.* (2nd Edition). Allyn and Bacon. Massachusetts. U.S.

Newbold, C. (1998). The Nature Conservation Importance of Flood plains in England and Wales - With Particular Reference to Their Flora. In **Bailey, R.G., Jose, P.V. and Sherwood, B.R. [Eds.]** (1998). *United Kingdom Flood plains*. Westbury Academic and Scientific Publishing, Otley, West Yorkshire.

Newbold, C., Honnor, J. and Buckley, K. (1989). *Nature Conservation and Management of Drainage Channels.* Nature Conservancy Council. Peterborough.

Newbold, C. (1998). The Nature Conservation Importance of Flood plains in England and Wales – With Particular Reference to Their Flora. In **Bailey, R.G., Jose, P.V. and Sherwood, B.R. [Eds.]** (1998). *United Kingdom Flood plains*. Westbury Academic and Scientific Publishing, Otley, West Yorkshire.

Newson, M. [Ed.]. (1992). *Managing the Human Impact on the Natural Environment: Patterns and Processes.* Belhaven Press, London.

Newson, M. (1992a). Introduction: Managing the Natural Environment - Why and How? In **Newson, M. [Ed.].** (1992). *Managing the Human Impact on the Natural Environment: Patterns and Processes.* Belhaven Press, London.

Newson, M. (1992b). Environmental Economics: Resources and Commerce. In **Newson, M. [Ed.].** (1992). *Managing the Human Impact on the Natural Environment: Patterns and Processes.* Belhaven Press, London.

Norris, S. (2002). Water: The Last Chance Saloon? In *Birds*, winter 2002. RSPB, Sandy, Bedfordshire.

Noss, R.F. and Harris, L.D. (1986). Nodes, Networks and NUMS: Preserving Diversity at all Scales. In **Rieley, J.O. and Page, S.E. [Eds.]** (In Press) *Habitat Creation and Wildlife Conservation.* Packard. Chichester.

Noss, R.F. (1987). Protecting Natural Areas in Fragmented Landscapes. In *Natural Areas Journal,* **7,** 2 - 13.

Office of the Deputy Prime Minister. (1999). *Towards an Urban Renaissance: The Report of the Urban Task Force Chaired by Lord Rogers of Riverside.* ODPM, UK.
Available at: http://www.urban.odpm.gov.uk/whitepaper/taskforce/renais/1.htm [Accessed December, 2002].

O'Sullivan, J. (1995). Wetlands of Europe. In *Naturopa*, **No.77**, 19 - 20. Council of Europe. Strasbourg, France.

Payne, A. and Loffler, P. (1999). The Aalborg Charter – Cities and Towns on the Move Towards Sustainability. In *Naturopa*, **No. 89**. Council of Europe. Strasbourg, France.

Pearce, D.W. and Turner, R.K. (1990). *Economics of Natural Resources and the Environment.* Harvester Wheatsheaf, Hemel Hempstead.

Percival, S.M. (2000). Birds and Wind Turbines in Britain. In *British Wildlife*, **Vol. 12**, No. 1. pp8 – 15. Hampshire.

Pettigrew, A.M. (1985). Contextualist Research: A Natural Way to Link Theory and Practice. In **Lawler, E.E., Mohrman, A.M., Ledford, G.E. and Cummings, T.G.** (1985). *Doing Research That is useful for Theory and Practice.* Jossey Bass, San Francisco, US.

Petts, G.E. (1998). Flood plain Rivers and Their Restoration: A European Perspective. In **Bailey, R.G., Jose, P.V. and Sherwood, B.R. [Eds.]** (1998). *United Kingdom Flood plains.* Westbury Academic and Scientific Publishing, Otley, West Yorkshire.
Petts, G.E., Heathcote, J. and Martin, D. (2002). *Urban Rivers: Our Inheritance and Future.* IWA, London.

Pickering, S. (1996). 2000 Years of Wetland Loss. In *Wildfowl and Wetlands*, **Issue 115**, 16 - 19.

Purseglove, J. (1988). *Taming the Flood.* Oxford University Press. Oxford.

Pygott, J. (1995). Restoration, Ecology and Rivers – Back to the Source? In *Journal of Practical Ecology and Conservation,* **Vol. 1,** No. 1.

Rackham, O. (1986). *The History of the Countryside,* J.M. Dent & Sons. London.

Ratcliffe, D.A. (1977). *A Nature Conservation Review.* Cambridge University Press. Cambridge.

Ratcliffe, D.A. (1981). The Purpose of Nature Conservation. In *Ecos*, **2** (3), 8 – 13.

Rayment, M. (1998). *Spending by Visitors to RSPB Reserves: Results from the Reserves Visitor Survey, 1998.* RSPB. Sandy, Bedfordshire.

Rayment, M., & Dickie, I. (2001). *Conservation Works.....for local economies in the UK.* RSPB. Sandy, Bedfordshire.

Rich, T.C.G. (1994). Wildlife Corridors. In *In Practice,* **11**, May, 1994. Institute of Ecology and Environmental Management, Newbury, Berkshire.

Rieley, J.O. and Page, S.E. [Eds.] (In Press) *Habitat Creation and Wildlife Conservation.* Packard. Chichester.

Roberts, M. [Ed.] (2001). *Yorkshire Wildlife Trust Potteric Carr Nature Reserve Bird Report, 2000.* Yorkshire Wildlife Trust, York.

Robson, C. (2002). *Real World Research.* (2nd Edition). Blackwell, Oxford.

Rodwell, J.S. [Ed.] (1995 - 2000). *British Plant Communities Volumes 1 - 5.* Cambridge University Press, Cambridge.

Rohde, C.L.E. and Kendle, A.D. (1994). Human Well-being and Nature in Urban Areas, *English Nature Science, No.22,* English Nature, Peterborough.

Rose, L., Dixon, J. and Lasen-Diaz, C. (1998). A Conservation Agenda for Europe. In *RSPB Conservation Review*, **12.** RSPB. Sandy, Bedfordshire.

Rotherham, I.D. (Undated). *River Rother Wildlife Strategy - Briefing Note.* Unpublished briefing note, Sheffield City Council.

Rotherham, I.D. (1999). Urban Environmental History: The Importance of Relict Communities in Urban Biodiversity Conservation. In, *Journal of Practical Ecology and Conservation*, **3**(1), 3-22.

Rotherham, I.D. (2001). *Pondscapes and Wet Meadows: Woodhouse Washlands Nature Reserve Management Plan Review: The First Five Years and Wetland Management Plan for the Period 2001 – 2006.* Sheffield Hallam University.

Rotherham, I.D. and Cartwright, G. (1986). *Lower Don Valley – Wildlife and Geology: A Preliminary Report.* Sheffield City Council, Museums Department.

Rotherham, I.D. and Cartwright, G. (2000a). The Potential of Urban Wetland Conservation in Economic and Environmental Renewal – A Case Study Approach. In *Journal of Practical Ecology and Conservation*, Vol. 4 (1). Wildtrack Publishing, Sheffield.

Rotherham, I.D. and Cartwright, G. (2000b). *Urban Wetland Conservation: Case Studies in Environmental and Economic Renewal.* Unpublished poster paper at the Wetlands 2000 Conference, PLACE, Ripon and York College, York.

Rotherham, I.D., Cartwright, G. and Watts, R. (2000). *Airport, Steelworks or Historic Landscape: The Sheffield Airport Development as a Case Study of Integrated Site Planning.* Abstract proceedings, SER 2000 Conference, Liverpool.

Rotherham, I.D., Doncaster, S. and Egan, D. (2002). *Potteric Carr Nature Reserve: The Green Gateway to Doncaster.* Unpublished consultancy report for the Countryside Agency produced by the Centre for Environmental Conservation and Outdoor Leisure at Sheffield Hallam University.

RSPB. (undated [a]). *Eighty Top Wetland Sites in Danger.* RSPB. UK.
Available at: http://www.rspb.org.uk/news/archive/288.htm [Accessed February, 2000].

RSPB. (undated [b]). *Loss of Wetlands Increases Flood Risk.* RSPB. UK.
Available at: http://www.rspb.org.uk/news/archive/227.htm [Accessed February, 2000].

RSPB. (undated [c]). *Calling All Bitterns* [Online]. RSPB. UK.
Available at: http://www.rspb.org.uk/news/archive/357.htm [Accessed February, 2000].

RSPB. (undated [d]). *Britain's Bitterns Go Astray* [Online]. RSPB. UK.
Available at: http://www.rspb.org.uk/news/archive/408.htm [Accessed February, 2000].

RSPB. (undated [e]). *Impacts of Climate Change.* [Online]. RSPB. UK.
Available at: http://www.rspb.org.uk/wildlife/climate/impacts/impactmore.asp [Accessed October, 2000].

RSPB. (undated [f]). *Conservation Science Department, Aquatic Section – Bittern Research and Monitoring.* [Online]. RSPB. UK.
Available from: http://www.rspb.org.uk/wildlife/scisurv/staffpub/aquatic.asp [Accessed October, 2000].

RSPB/The British Trust for Ornithology. (1999). The *State of the UK's Birds, 1999.* RSPB. Sandy, Bedfordshire.
RSPB. (1992). *Action for Birds and the Environment - the RSPB Environmental Manifesto for the 1990's.* RSPB. Sandy, Bedfordshire.

RSPB. (2001). *Old Moor and the Dearne Valley Wetlands: Outline Management Plan, 2002 – 2006.* RSPB, Denby Dale.

RSPB. (2002). *Reedbeds - management.* RSPB. Sandy, UK.
Available from: www.rspb.org.uk/wildlife/ [Accessed: September 2002].

Rubec, C.D.A. (1993). The Federal Policy on Wetland Conservation in Canada. In **Davis, T.J.** (1993). *Towards the Wise Use of Wetlands.* Ramsar Convention Bureau. Gland, Switzerland.

Rudestam, K.E. and Newton, R.R. (2001). *Surviving Your Dissertation: A Comprehensive Guide to Content and Process*. Sage, London.
Salathe, T. (1993). Towards Integrated Management of Coastal Wetlands of Mediterranean Type. In **Davis, T.J.** (1993). *Towards the Wise Use of Wetlands*. Ramsar Convention Bureau. Gland, Switzerland.

Salathe, T. (2000). *The Role of Wetlands in Maintaining 'Good Water' Status*. Worldwide Fund for Nature, European Freshwater Programme, Brussels.
Available from: http://www.wwfreshwater.org/seminars/sem2/salathe.htm [Accessed April, 2001].

Salwasser, H. (1987). *Greenways for Americans*. Cited in Adams, L.W. and Dove, L.E. (1989). *Wildlife Reserves and Corridors in the Urban Environment: A Guide to Ecological Landscape Planning and Resource Conservation*. National Institute for Urban Wildlife, Columbia, US.

Scott, D.A. [Ed.} (1982). *Managing Wetlands and Their Birds*. International Waterfowl Research Bureau, Slimbridge, UK.

Scott, N.E. (1991) Creating Wetlands After Opencast Mining. In **Rieley, J.O. and Page, S.E. [Eds.]** (In Press) *Habitat Creation and Wildlife Conservation*. Packard. Chichester.

Seffer, J. (2000). The Economic Value of Flood Plains in the Danube Basin: The Morava Meadows. In **Worldwide Fund for Nature.** (2000). *Implementing the EU Water Framework Directive: A Seminar Series on Water - Seminar 2: The Role of Wetlands in River Basin Management*. WWF Europe, Brussels.
Available from: http://www.panda.org/downloads/europe/sem-2proc.pdf [Accessed July, 2002].

Sheffield Economic Regeneration Committee. (1987). *Lower Don Valley: Final Report*.

Silverman, D. (2000). *Doing Qualitative Research: A Practical Handbook*. Sage, California, US.

Smith, K., Welch, G., Tyler, G., Gilbert, G., Hawkins, I. and Hirons, G. (2000). Management of RSPB, Minsmere, Reserve Reedbeds and its Impact on Breeding Bitterns. In *British Wildlife*, **Vol. 12**, No. 1. pp16 – 21. Hampshire.

Spellerburg, I.F. and Gaywood, M.J. (1993) *Linear Features: Linear Habitats and Wildlife Corridors*. English Nature Research Report No. 60. English Nature, Peterborough.

Spreafico, M. (2003). The Rhine River – Lifeline of Large Cities in the Basin: A Case Study. [Online] World Meteorological Organization, Geneva, Switzerland.
Available from: http://www.wmo.ch/web/Press/rhine.html [Accessed August, 2003].

Stanners, D. and Bourdeau, P. [Eds.] (1995). *Europe's Environment: The Dobris Assessment*. European Environment Agency. Copenhagen, Denmark.

Stevenson, A. and Newson, M. (1992). Natural Environments of the Future: Adapting, Conserving, Restoring. In **Newson, M. [Ed.].** (1992). *Managing the Human Impact on the Natural Environment: Patterns and Processes*. Belhaven Press, London.

Streever, W. [Ed.] (1999). *An International Perspective on Wetland Rehabilitation*. Kluwer Academic Publishers. Dordrecht, The Netherlands.

Stringer, E.T. (1999). *Action Research: A Handbook for Practitioners*. (2nd Edition). Sage, California, US.

Sutherland, W.J. (1998). *Conservation Science and Action*. Blackwell. Oxford.

Sutherland, W. J. (2000). *The Conservation Handbook – Research, Management and Study*. Blackwell. Oxford.

Swash, A.R.H. (1998). The Environmental Aspects of Riverine Flood plain Management: What is MAFF's Involvement? In Bailey, R.G., Jose, P.V. and Sherwood, B.R. [Eds.] (1998). *United Kingdom Flood plains*. Westbury Academic and Scientific Publishing, Otley, West Yorkshire.

SWR. (2002). *A Feasibility Study for the Doncaster Environment Centre, Potteric Carr, Doncaster*. Volumes 1 - 3. Scott Wilson, Leeds. In association with Ryder.

Szijj, J. (1988). *Ecological Requirements for the Integrated Management of Coastal Wetlands of Mediterranean Type*. Final Typescript Report to EEC/DG XI.

The Ramsar Bureau. (2000). *Wetland Values and Functions: Flood Control*.

Available from: http://ramsar.org [Accessed December, 2000].

Tyler, G. (1994). Management of Reedbeds for Bitterns and Opportunities for Reedbed Creation. In *RSPB Conservation Review* 8: 57 – 62, RSPB. Sandy, Bedfordshire.

Tucker, G.M. and Evans, M.I. (1997). *Habitats for Birds in Europe: A Conservation Strategy for the Wider Environment*. Birdlife International. Cambridge.

UNCED. (1992). *Convention on Biological Diversity*. United Nations Conference on Environment and Development. Rio de Janeiro, Brazil.

Ulrich, R.S., Simmons, R.F., Losito, B.D., Flority, E., Miles, M.A. and Zelson, M. (1991). Stress Recovery During Exposure to Natural and Urban Environments. **In** *Journal of Environmental Psychology*, **11**, 201 – 230.

U.S. Department of the Interior. (1994). *The Impact of Federal Programs on Wetlands, Vol. II: A Report to Congress by the Secretary of the Interior.* U.S. Fish and Wildlife Service, Arlington, U.S.A.

Van der Noort, R. and Ellis, S. (1997). *Wetland Heritage of the Humberhead Levels*. Humber Wetlands Project. Hull.

Veal, A.J. (1992). *Research Methods for Leisure and Tourism: A Practical Guide.* Pitman Publishing, London.

Voisin, C. (1991). *The Herons of Europe*. T & A.D. Poyser. London.

Ward, D., Holmes, N. and Jose, P.V. [Eds.] (1994). *The New Rivers and Wildlife Handbook*. RSPB. Sandy, Bedfordshire.

Watts, R., Pearson, R. and Rotherham, I.D. (1987). New Life for the Lower Don Valley. **In** *Landscape Design*. February, 1987 issue.

Weber, U. (2000). *The 'Miracle' of the Rhine*. [Online] Press report, The Basler Zeitung newspaper, Basel, Switzerland.
Available from: http://www.unesco.org/courier/2000_06/uk/planet.htm [Accessed August, 2003].

Weddell, B.J. (2002). *Conserving Living Natural Resources in the Context of a Changing World.* Cambridge University Press, Cambridge.

Wentz, W. (1988). Functional Status of the Nation's Wetlands. In **Hook, D., McKee, W., Smith, A., Gregory, V., Burrell, V., DeVoe, M., Sojka, R., Gilbert, S., Banks, R., Stolzy, L., Brooks, C., Matthews, T. and Shear, T. [Eds.]** (1988). *The Ecology and Management of Wetlands Volume 2: Management, Use and Value of Wetlands*. Croom Helm. Kent.

Wescoat, J.L. and White, G.F. (2003). *Water for Life: Water Management and Environmental Policy*. Cambridge University Press, UK.

Willis, W. and Garrod, G. (1990). *Valuing Open Access Recreation on Inland Waterways.* Countryside Change Working Paper Series. Department of Agricultural Economics and Food Marketing, University of Newcastle upon Tyne. Newcastle upon Tyne.

Willis, W. and Garrod, G. (1991). *Landscape Values: A Contingent Valuation Approach and Case Study of the Yorkshire Dales National Park.* Countryside Change Working Paper Series. Department of Agricultural Economics and Food Marketing, University of Newcastle upon Tyne. Newcastle upon Tyne.

Winpenny, J.T. (1991). *Values for the Environment: A Guide to Economic Appraisal.* Overseas Development Unit. HMSO, London.

Worldwide Fund for Nature. (undated). *Europe's Living Waters – An Agenda for Action. The importance of Europe's rivers*. WWF. UK.
Available from: http://www.panda.org/resources/publications/water/living.rivers/importance.htm [Accessed November 1999].

Worldwide Fund for Nature. (2000). *European Freshwater Programme – The EU Water Framework*. WWF. UK.
Available from: http://www.wwffreshwater.org/initiatives/wfd.html [Accessed October 2000].

Worldwide Fund for Nature. (2000). *European Freshwater Programme – Water and Wetland Index*. WWF. UK.
Available from: http://www.wwffreshwater.org/initiatives/wwi.html [Accessed October 2000].

Worldwide Fund for Nature. (2000). *Policy and Economic Analysis of Flood plain Restoration in Europe: Opportunities and Obstacles.* WWF Wise Use of Flood plains: LIFE Environment Project, Denmark. Available from: http://www.flood plains.org/uploads/policy%20and%20economic%20analysis,%20wwf%report.pdf [Accessed July, 2002].

Worldwide Fund for Nature. (2000). *Implementing the EU Water Framework Directive: A Seminar Series on Water - Seminar 1: Water and Agriculture.* WWF Europe, Brussels. Available from: http://www.panda.org/downloads/europe/sem-1proc.pdf [Accessed July, 2002].

Worldwide Fund for Nature. (2000). *Implementing the EU Water Framework Directive: A Seminar Series on Water - Seminar 2: The Role of Wetlands in River Basin Management.* WWF Europe, Brussels. Available from: http://www.panda.org/downloads/europe/sem-2proc.pdf [Accessed July, 2002].

Worldwide Fund for Nature. (2001). *Elements of Good Practice in Integrated River Basin Management: A Practical Resource for Implementing the Water Framework Directive.* WWF Europe, Brussels. Available from: http://www.panda.org/downloads/europe/wfdpracticalresourcedocumentenglish.pdf [Accessed July, 2002].

Worldwide Fund for Nature. (2001). *Implementing the EU Water Framework Directive: A Seminar Series on Water - Seminar 3: Good Practice in River Basin Planning.* WWF Europe, Brussels. Available from: http://www.panda.org/downloads/europe/sem-3proc.pdf [Accessed July, 2002].

Worldwide Fund for Nature. (2001). *WWF Danube-Carpathian Programme: Lower Danube Green Corridor Initiative.* WWF Europe, Brussels. Available from: http://www.panda.org/about_wwf/where_we_work/europe [Accessed August, 2003].

Yin, R.K. (1994). *Case Study Research: Design and Methods.* (2nd Edition). Sage, California, US.

Yorkshire Water Services Ltd. (undated). *Yorkshire Water Services in the Environment* [Online], Yorkshire Water Services Ltd. Bradford. Available from: http://www.yorkshirewater.plc.uk/enviro/home.htm [Accessed October 1999].

YWT. (1986). *Potteric Carr Nature Reserve: Visitors Guide.* Yorkshire Wildlife Trust. York.

YWT. (2002). *Potteric Carr Nature Reserve: Proposals for the Development of the Reserve.* Yorkshire Wildlife Trust. York.

APPENDICES

APPENDIX 1

MAINLAND EUROPEAN CASE STUDIES - THE RIVERS RHINE AND DANUBE.

European case study examples.

Of many projects to restore or rehabilitate wetlands and riverine features along river corridors in Europe two examples of projects that are multi-purpose and demonstrate cross-boundary cooperation are those on the Rivers Rhine and Danube.

The River Rhine.

The River Rhine is 1,320 kilometres long with an estimated catchment area of 185,000 square kilometers. It rises in the Alps in Switzerland and travels through Austria, Germany, France and Luxembourg before flowing into the North Sea in Holland. The catchment has an area of 185,000 square kilometers and is densely populated with a population in excess of 50 million and all its major cities adjacent to the river (Spreafico, 2003). A schematic diagram of the river course is shown in **Figure Ap.1**.

Figure Ap.1: **Map of the course of the River Rhine.** (Source: ICPR).

For decades industrial and domestic waste flowed into the river and it was classed as grossly polluted from the 1950s to the 1970s. Pollution from river transport also became a serious problem, particularly with the Rhine being a major transport conduit across central Europe. **Figure Ap.2** shows the Rhine as a busy transportation route.

Figure Ap.2: Commercial barges on the Rhine. (Source: ICPR).

Despite it once being an important salmon (*Salmo salar*) spawning river fish disappeared and it was reported to be dangerous to swim (Foulkes, 2001).

Holland had been complaining about the pollution in the river as that country became the sump for anything that was added to the water upstream. Levels of phenol and salt made treatment of water for potable supply extremely difficult and called a meeting of the Rhine-bordering countries together to address the problem. This resulted in the formation of the *International Commission for the Protection of the Rhine against Pollution* (ICPR) in 1950. Over the next two decades various problems were examined and solutions proposed but the catalyst for improving the river quality came in 1986 following a fire at a Basel chemical plant which caused tonnes of toxic pesticides to leak into the river. Following this, ministers of the member states approved the implementation of the *Rhine Action Programme* which aims to keep the riverine ecosystem in good 'health' and to restore species that have disappeared. The return of the salmon by the year 2000 is a visible indication of the success of the project. To achieve this water quality had to be improved by reducing nutrient and pollutant inputs by improved production techniques and better wastewater treatment technology. There has been considerable success in reducing point source pollutants but there is still a problem with diffuse agricultural sources (Anon., online, undated [h]).

It was soon realized that salmon needed more than better water quality to be persuaded to return to their historical spawning grounds on the river. Of equal importance is the physical nature of the river in terms of its physical structure (large sections canalized for navigation and flood control reasons; the river bed (often subject to a cycle of silting and dredging); the river banks and the adjacent flood plains (and the flora present there). It is reported that 80% of the former flood plains of the Rhine valley have disappeared due to some form of development. As in many river flood defence schemes the accent has been to move the water as fast as possible downstream so it

becomes someone else's problem. These policies have only exacerbated the flooding problem because the flood event is not slowed as it spreads and travels through wetlands in the flood plains. For the Upper Rhine the problem of excessive flood flow is worsened by the fact that the river channel has been shortened by 82 kilometres and the Lower Rhine by 23 kilometres. Construction for shipping and hydroelectric power have destroyed fish habitats and provided insurmountable barriers to fish migration. **Figure Ap.3** (overleaf) shows schematic diagrams of the River Rhine in Germany in 1838 and 1989. It can be seen that channel engineering has made the modern river narrower and deeper than the natural channel. This has isolated associated wetlands and permitted waterside industrialisation. The *Rhine Action Programme* focused on two points:

* restoration of the main stream as the backbone of the ecosystem
* protection, preservation and improvement of reaches of ecological importance.

(Anon., online undated [h]). Construction has been carried out at a cost of about $6 million to create a fish pass on the river at Iffezheim with further plans for similar treatment at Gambsheim in Alsace (Weber, 2000).

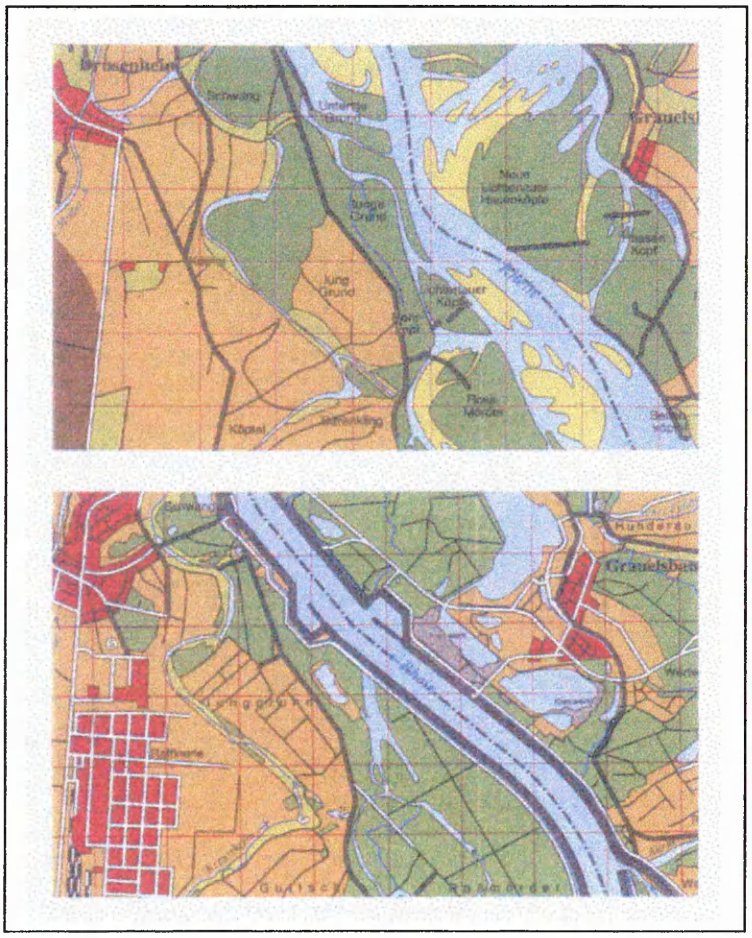


Figure Ap.3: **Schematic diagrams of the River Rhine showing the effects of channel engineering.** (Source: Petts, Heathcote and Martin, 2002).

More recent policies of IPCR have looked at the issues of ecology and flood control for the river. It is recognised that floods are natural events and that they are necessary for the creation of a typical flood plain profile. The plan is to restore the ability of the flood plain to store water in enhanced or re-created wetlands in designated flood zones. This will be achieved through planning regulations for new development, protection of existing storage

areas, integrating the equivalent of the UK's *sustainable urban drainage systems* into urban settlements and to reduce discharges where possible (Anon., online undated [h]).

The River Danube.

The Danube river basin covers 817,000 square kilometers and the river is Europe's second longest at 2,857 kilometres from Germany's Black Forest to the Ukranian and Romanian Danube Delta at the Black Sea. It crosses ten countries and the basin drains seventeen. The European Commission now recognises the Danube as the single most important non-oceanic body of water in Europe and the future central axis for the enlarged European Union (Anon., online, undated [i]). The course of the river is shown in **Figure Ap.4**.

Figure Ap.4: **Map of the course of the River Danube through Europe.** (Source: ICPDR).

Approximately 83 million people live in the basin and more than 20 million depend on the river for drinking water. Over its course the river has a diverse system of natural habitats including Germany's flood plain woodlands, alpine habitats in the Alps and the Carpathian mountains, the Hungarian puszta plains, the Bulgarian islands and the huge reed beds and marshes of the Danube Delta (as depicted in **Figure Ap.5**). The 600,000 hectare Danube Delta is a UNESCO World Biosphere Reserve and the largest reed bed in the world. The Delta is home to over 300 species of birds (of which over 176 species breed) and the river as a whole holds over 100 different species of fish, with endangered species such as sturgeon (*Acipenser sp.*) (Anon., online, undated [i]; Anon., online, 1991; Heliotis *et al.*., 1994). Only 9% of the Delta area is permanently above water and consists not only of the huge reed beds but also of numerous freshwater lakes interconnected by narrow channels. Because each year thousands of tonnes of alluvial silt are carried into the delta by the river there is a constant reshaping of the river banks and sandbars. Other aquatic habitats include flooded islets, riverine willow (*Salix* sp.) and poplar (*Populus sp.*) forests, cane fields, sandy and muddy beaches, and wet meadows. The site is internationally significant for birds, both breeding and migratory, including a number of globally-threatened species (Anon., online, 1991).

Figure Ap.5: Danube Delta reed bed.
(Source: Danube Delta Biosphere Reserve Authority).

Despite this seeming ecological richness Heliotis *et al.*. (1994) suggest that the complex and varied ecosystems had undergone dramatic deterioration in the 1980s and early 1990s following political decisions made by the former communist regime to intensify reed and fish exploitation and to intensify agricultural production through the creation of immense dyked and drained areas called polders. These were used for large-scale agricultural production. The consequence of this was that they had reduced the flooded area in the Delta by 25% since 1960. Before this small-scale, traditional methods of sustainable agriculture had been practiced in the Delta, with small plots being cultivated on silt deposits on the smaller channels and on small fields around villages. In recognition of the fact that such large-scale production was unsustainable due to the loss of wetlands being contingent with a loss of nutrient retaining capacity in the Delta and in declining fisheries, the Danube Delta Biosphere Reserve management has given high priority to restoration of reed beds in selected areas. Heliotis *et al.*. go on to say that there is significant economic potential for the reed beds if they are open to the sediments and nutrients that are carried in the river flow. Breaching the embankments of the diked polders would allow regeneration of these reed beds (Heliotis *et al..*, 1994).

2,414 kilometres of the River Danube is navigable though the creation of the Rain – Main – Danube navigation system has created a navigable river way of 3,515 kilometres which connects the Black Sea with the North Sea and has enormous economic significance (Chincea, online, 2000). Until the end of the nineteenth century the Danube was a wide, branching river with an extensive network of side arms and backwaters. Its course frequently changed and the basin had a dynamic floodplain ecosystem. Since then, in a similar way to the Rhine and many other rivers, there have been drastic human interventions to 'improve' flood protection, agriculture, power production and waterway transport. It is estimated that these interventions have destroyed over 80% of the basin's

environmentally vital and economically valuable wetlands, flood plains and flood plain forests. This has been accompanied by a large loss of biodiversity with one example being the huge decline in the presence of the sturgeon which only exists in isolated pockets (Anon., online, undated [i]).

Physical, engineered adaptations to the river course vary in relation to their position in relation to former political divisions. For instance, in communist Central and Eastern Europe the riverine flood plains were drained for unsustainable agriculture and forestry practices but many areas were also left untouched for the forty years of communist rule. Yet in Western Europe, the first 1,000 kilometres of the river were developed into an almost continuous artificial waterway with a series of 59 hydro-electric dams but for the 'communist' section for more than 1,800 kilometres downstream to the Black Sea there are only two dams. This section generally possesses a higher level of biodiversity than the upper reaches in Western Europe (Anon., online, undated [i]).

Much of the Danube has been channelised for flood protection works and for navigation thus destroying the diverse network of side channels and tributaries to form a straighter and deeper channel. Consequent lack of available water to floodplain areas meant significant losses of wetlands with an example on the River Tisza in Hungary (a tributary of the Danube) where 2,590,000 hectares of flood plains were reduced to 100,000 hectares. New shipping developments are still being proposed which threaten rare species, decrease the availability of drinking water, and are likely to increase levels of chemical pollutants. There are widespread point source and diffuse pollution issues (Anon., online, undated [i]).

To address these issues the various countries which are dependent on the Danube to some extent have come together to act in an integrated way to provide solutions to the many and various problems. The *International Committee for the Protection of the Danube River* (ICPDR) is a decision-making body with representatives acting as the Contracting Parties to various initiatives to improve the condition and functions of the river. One such initiative is the *Danube River Protection Convention* (DRPC), initiated in 1998, whose aim is to include the protection and effective use of surface waters and groundwater bodies. A *Joint Action Programme* (JAP) has resulted in plans for a major initiative to construct wastewater treatment plants at key locations in several contracting countries by 2005. This will lead to a dramatic reduction in the river's pollution load from domestic and industrial effluents and from agricultural point source pollution (ICPDR, 2000). The JAP promotes the use of a River Basin Management approach that requires significant cooperation from all contracting countries and is in line with the proposals of the Water Framework Directive for such catchment management.

Other initiatives addressing other issues in the basin are also occurring concurrently. The *Strategic Action Plan* of the *Danube River Environment Programme* which was adopted in 1994 acknowledged the important role that wetlands play in the nutrient balance of the river. It was recognised that flood plains perform an essential role in water purification, reduce flood hazards and preserve a disappearing biodiversity. In recognition of these facts the European Union, through its PHARE funding scheme, has supported projects involving the restoration of wetlands. In prioritizing projects for action attention was given to small-scale projects that would not only save the values of individual wetlands but which would re-establish corridors and connectivity. A key factor for the grant of funding was the proven likelihood of success. This latter factor was seen to critically involve involvement of people at a local level. It is understood that the more the local population understands and supports the project, the more effective the results. The intention being that a lot of small-scale projects that were linked could equate to potentially significant changes in the ecological, social and economic health of the Danube system (Anon., 2000f).

A further initiative as part of the *United Nations Development Programme* has been a trans-boundary analysis to identify potential sites for wetland restoration as part of the *Pollution Reduction Programme* for the river. The survey, supervised by WWF, investigated more than 6,000 kilometres of river stretches on the Danube and its tributaries. The study found that only 20% of the former flood plain area is left. A conclusion has been that such restoration of wetlands may be one of the most effective and important strategies in addressing the problems of the Danube River, its Delta and the Black Sea. Most of the sites identified were working or abandoned agricultural land on the polders where it would be simple to breach dykes and allow the land to flood naturally. Significantly, the countries of the Lower Danube have collaborated to bring about the creation of a *Lower Danube Green Corridor* connecting the potentially restored wetlands with existing protected areas (including the world biosphere reserve at the Danube Delta), and with newly created protected areas (Anon., 2000f). The Corridor aims to reconnect these isolated habitat islands to form an interconnected system amounting to approximately 1,200,000 hectares of prime wetland habitat. This will expand the Danube's natural capacity for pollution reduction, flood retention and nature conservation. Management of the flood plains will also aim to optimize socio-economic benefits to local communities (Worldwide Fund for Nature, online, 2001).

APPENDIX 2

TIMETABLE FOR ACTION AND THE WORLDWIDE FUND FOR NATURE'S SEMINARS ON IMPLEMENTATION OF THE EUROPEAN UNION'S WATER FRAMEWORK DIRECTIVE.

TIMETABLE FOR ACTION FOR IMPLEMENTATION OF THE EUROPEAN UNION'S WATER FRAMEWORK DIRECTIVE.

Year end.	Deadline implications.
2000	No further deterioration of water status permitted.
2003	WFD transposed into national legislation.
2003	River Basin Districts identified.
2004	Analysis of pressures/impacts/economic uses completed.
2006	Monitoring programmes operational.
2006	Public consultation on River Basin *Management Plans.*
2009	River Basin Management Plans published.
2010	Pricing policies in place.
2012	Programme of measures operational.
2015	Environmental objectives achieved.

Deadlines for Water Framework Directive implementation. (Anon., 2000b)

The WFD sets out this phased process with strict deadlines for achieving *'good status'*. The key steps from this with regard to river basin planning are as follows:

* **Setting up of River Basin Districts.**
  By 2003 at the latest, all river basins and coastal waters must be assigned to a River Basin District and the competent authority for each identified.
* **Data gathering and analysis.**
  By 2004, at the latest, all surface- and ground-waters must be characterised in accordance with procedures set out in the WFD.
* **Designing and implementing a 'programme of measures' for each RBD.** By 2009 Member States must have established a programme of measures for each RBD composed of both basic and supplementary measures for achieving and/or maintaining 'good status'.
* **Preparing River Basin Management Plans.**
  Every Member State must ensure that a River Basin Management Plan (RBMP) is produced for each RBD wholly within its territory. Details of the elements that must be covered in the plan are outlined in an annex to the report.
* **Establishing monitoring networks.**
  Member States are required to establish monitoring programmes in order to establish a coherent and comprehensive overview of water status within each RBD. Such monitoring must cover both surface- and ground-water, and has to be operational by 2006.
* **Encouraging the active involvement of all interested parties in the implementation of the WFD.**
  Member States are obliged to ensure that draft RBMPs are published for public consultation and comment at least one year before the start of the period to which the plan refers.

Amongst the Directive's other key provisions, which form an integral part of the above process are:

* **Introduction of water pricing policies that provide adequate incentives for efficient use of water (by 2010).**
* **Control of all pollutant emissions and discharges into surface waters (by 2012).**

THE WORLDWIDE FUND FOR NATURE'S SEMINARS ON IMPLEMENTATION OF THE EUROPEAN UNION'S WATER FRAMEWORK DIRECTIVE.

Conclusions from the Worldwide Fund for Nature's Water Framework Directive ***'Water and Agriculture'*** (February, 2000) seminar are shown below:

* Despite regional differences agricultural impacts on water status are a major concern across Europe, both in terms of water quality and quantity. This impacts on the biodiversity and landscape of Europe and threatens human health and the long-term sustainability of food production.
* Some of the existing legislation, such as the EU Nitrates Directive, has had little effect on combating some problems due to inadequate implementation by many Member States. Subsidies derived from the Structural/Cohesion Funds and the Common Agricultural Policy (CAP) have supported intensive farming methods which have added to the pollution burden and to further extension of irrigation, regardless of environmental, social or economic sustainability.
* Dependent on Member States' commitment to implementing the policy, the opportunity is provided for attaching environmental conditions to CAP payments at the national level in the Agenda 2000 CAP reforms.
* There can be uneasy trade-offs between the need to reach environmental standards and the social goals of sustaining farm incomes and employment. Incentives and compensation measures to obtain agricultural change should help.
* A greater share of the funding available in the CAP needs to be transferred to policy instruments such as agri-environment and sustainable rural development (under the Rural Development Regulation) to support and strengthen the long-term implementation of the Water Framework Directive.
* The Water Framework Directive will offer a planning process that will help assess impacts and co-ordinate interventions at the appropriate geographic and hydrological scale. The requirement for a transparent, participative planning process, which enables stakeholders to influence decision-making, was seen as crucial.
* Public opinion is likely to increasingly target environmental standards and food safety as key issues. Consequently there needs to be a shift from giving primary concern to farm incomes and to recognise the environmental needs for improved agricultural practice and to the limitations of water supplies. (Anon., 2000c)

The conclusions from the Worldwide Fund for Nature's Water Framework Directive second seminar, ***The Role of Wetlands in River Basin Management'*** (November, 2000), are shown below:

* Wetlands are a central component of the hydrological cycle, performing economically and environmentally valuable functions to regulate water quality and quantity. The sustainable management of wetlands should therefore be a key element of effective river basin management.
* Available information shows that 50% or more of Europe's original wetland resource has been lost and many of the remaining wetlands are seriously degraded.
* This means that the natural functions and values of European wetlands have been seriously reduced. In terms of river basin management this may increase vulnerability of entire basins to flooding and

pollution. Restoration of wetland area and rehabilitation of wetland functions can play a vital role in long-term cost effective management of water quantity and quality.

* Wetland loss and degradation are indicators of unsustainable development.
* The Water Framework Directive establishes an obligation to undertake an economic analysis of each river basin. This should include the economic values of wetlands and their functions. Standards should be developed for 'good wetland status'. This should draw on relevant experience under other instruments, such as the Habitats Directive and the Ramsar Convention.
* Implementation of the Directive will be strongly influenced by a wide range of other EU policy, financial and legislative tools, particularly in the agricultural and regional development sectors. Long-term success in achieving 'good status' for surface and groundwaters throughout the EU will only be realised with fundamental reforms in these two major policy areas.
* Reforms introduced under Agenda 2000, together with more consistent application of cross compliance, can help towards better integration of environmental, agricultural and regional development instruments.
* Whilst policies at EU level are important in setting the overall framework and standards, national, regional and local policies and instruments can also have a huge impact on the extent to which wetland management is used as a tool for achieving 'good status' for water. (Anon., 2000d)

At the beginning of the Worldwide Fund for Nature's Water Framework Directive third seminar, ***'Good Practice in River Basin Planning'*** (May, 2001), a series of key questions to be addressed was proposed. The questions and a summary of the responses to each are shown below.

* **What does planning for integrated river basin management mean?**

Planning for river basin management has four clear elements, all of which are required in the context of WFD implementation:

- 'Planning': a rigorous framework in pursuit of long-term goals, namely the environmental objectives of the WFD;
- 'Integrated': there must be a wide range of genuine interactions within and between sectors and stakeholders and at different spatial, temporal and institutional levels;
- 'River basin': recognition that water resources are most appropriately managed at the basin (or component sub-basin) level;
- 'Management': the need to orient planning towards practical, field-level action.

* **What are the main components? What needs to be done?**
  - The WFD sets out clear steps. The central elements are the RBMP and the corresponding measures for each RBD.
  - These further require the setting up of effective information gathering and analysis mechanisms, appropriate monitoring networks, and genuine opportunities for stakeholder information, consultation and participation.
* **Who should do what?**
  - Different actors are relevant at different scales;
  - Roles and responsibilities should be clearly defined and mutually respected;
  - Strong and effective coordination is required to ensure that elements of river basin planning and management being pursued and implemented by different actors are coherent at sub-basin and RBD levels.
* **When should it be done?**
  - The WFD establishes a clear series of legally binding deadlines;

- The challenging timeframe means that actual implementation must begin as rapidly as possible, based on existing information, experience, structures and processes;
- However, early implementation must constantly be reviewed and adapted in the light of additional data gathering and lessons learned, with genuine openness to innovative approaches;
- Public information, consultation and participation should be incorporated from the earliest stages of WFD implementation.

* **What are the main ingredients of success and under which conditions?**

Successful examples tend to be characterised by:

- A step-by-step approach;
- Pragmatism;
- Openness and commitment to public information, consultation and participation;
- Commitment to awareness raising and capacity building (at all levels);
- Innovative thinking.

* **What are the main obstacles and how can these be overcome?**

Factors associated with less successful efforts include:

- Poor communication, both within the water sector and with other stakeholders;
- Technical perfectionism;
- Institutional inertia;
- Non-existent or superficial involvement of stakeholders;
- Underestimating the human and financial resources required.

(Anon., 2000b)

APPENDIX 3

BACKGROUND AND RATIONALE FOR THE RESEARCH STUDY.

Rationale for the study.

This study is a direct response to an increasing interest in wetland environments and their integrated social, economic and conservation potential. The Royal Society for the Protection of Birds, the Wildfowl and Wetlands Trust, the Wildlife Trusts and English Nature have all recognised and publicised the steady decline in wetland features, particularly in lowland Britain. Industry, development, agriculture, drinking water abstraction and recreation have all played their part in degrading riverine features, surface wetlands and underground aquifers; although there now appears to be a desire to make use of such sites in an integrated and sustainable way. This is partially evident from a conference to promote a management handbook on "Industry, Wildlife and Wetlands" (Merritt, 1994), where conservationists, water companies and industrial concerns came together with an attitude of exploring the possibilities rather than defending their rights.

The Earth Summit in Rio de Janeiro in 1992 has also had a dramatic effect on local issues and has begun to generate an atmosphere of co-operation between agencies that once had no common ground. 'Biodiversity' and 'sustainability' are now terms that are being used in diverse scenarios. Strategic viewpoints are becoming commonplace compared to the narrow focus of specific site development of recent years.

It is now common to examine issues in a European dimension, drawing on the skills and experience of our neighbours in the European Union and further afield. This is now of particular importance because of the introduction of the ***Water Framework Directive*** which has considerable implications for member states. This study makes use of case study examples at both regional and national levels, and with selected sites in mainland Europe where specific catchments are being examined in a similar way. Particular emphasis is given to local partnerships and contact with relevant agencies.

The aims of the study are:

* **To critically review the implications, impact and implementation of the Water Framework Directive in the catchment area.**

* **To critically review the relevant regional strategies and to assess their implementation.**

* **To assess the current status of key wetland environments and habitat-types in the River Don catchment.**

* **To consider site selection criteria and to develop a strategic approach for the enhancement of the catchment, and in particular address issues of sustainable integrated management, and development for conservation linked to social and economic renewal.**

* **To critically examine existing case studies, with regard to site selection criteria, resource provision and funding, and socio-economic influences.**

* **To evaluate and document the historical changes within this landscape; relating this to a review of the contemporary ecological resource, its conservation and recovery.**

* **To consider the economic and leisure/tourism implications of all the above.**

1.3 Scope of the study.

The background to the critical research for this project examines the suggestion that strategic integration of environmental projects in the social, political and economic development of a region is of singular significance. Policies and initiatives at international, national, regional and local levels will be of influence in this issue. The study will examine such influences and apply resultant concepts in their applicability to the case study area of the catchment of the Rivers Don, Dearne and Rother which lie mainly in the county of South Yorkshire. Of critical importance in the research into this region is the supposition that:

1. **Wetland management, enhancement and creation (all aspects of restoration) may present significant opportunities as a platform for regeneration and for balancing former environmental loss and degradation.**

2. **Wetland restoration projects have been critical in facilitating social and economic regeneration at local and regional levels.**

Wetlands are extremely important in people's lives in terms of their aesthetic and spiritual values alongside the more practical functions listed earlier. Increasingly, there is also recognition of their other economic functions of

tourism and recreation. There is also a growing awareness of the importance of environmental sustainability and biodiversity at local and governmental levels. This project will link closely into the South Yorkshire Biodiversity Research Programme, alongside existing projects that include an analysis of water quality in the Sheffield area and the impact of industrialisation and urbanisation on hydrology and their ecological consequences.

The project will also examine other issues such as:

* A reduced need for the use of marginal land for agriculture;
* An increase in the provision of storage areas in floodwater alleviation schemes;
* An increase in the number of restoration schemes in former mining areas (particularly on areas reworked as opencast mines);
* The recognition that surface wetlands are a key component in maintaining and recharging our underground aquifers (Hughes, 1992) [possibly depleted in the eastern area of the Don catchment by a growing demand for crop irrigation];
* The use of wetlands as a means of pollution prevention and waste processing.

It will address an increasing interest in sustainable management of existing wetlands and the potential for creating new ones.

Historically, the River Don catchment has provided the means for industrial development in the region since the Industrial Revolution and, to a more limited extent, before this. In association with this, there has been a rapidly expanding population around the urban centres of Sheffield, Rotherham, Barnsley and Doncaster. This has placed increasing pressure on the more rural parts of the lower part of the catchment for urban fringe-related land uses such as housing, road building, quarrying and landfill (Moss, 1995). Heavy industry in the study region has suffered a huge decline in its core industries of steel, coal, cutlery, and tool manufacture with an associated collapse of employment. Steel-based employment in the Lower Don Valley in Sheffield for example, declined from 40,000 to 13,000 jobs between 1975 and 1988, along with a legacy of dereliction and despondency. (Rotherham and Cartwright, 2000). One consequence of this unemployment is that the population has more time for, interest in, and access to leisure pursuits. Kendle and Forbes (1997) speculate that the re-introduction of wild areas to the urban environment is, for many people, a means to partially compensate for the loss from their everyday lives of the aesthetic, spiritual and recreational values which characterise the natural environment. Mostyn (1979) suggests that urban nature areas have potential value for humans on many levels (see **Figure 1** overleaf).

Emotional

* relief of escaping from the city
* opportunities to identify with nature
* sense of freedom
* a peaceful retreat to repair emotions
* a sense of pride and achievement

Intellectual

* seeing nature at work
* learning about the variety of flora and fauna
* learning about local history
* new skills

Social

* getting to know people better
* pleasure from team and community spirit
* becoming more responsible citizens

Physical

* appeals to the senses
* feeling fit
* a safe place to exercise or play

Figure 1: Personal benefits of participation of an urban wildlife area. (Source: Mostyn, 1979)

Sites for nature conservation within and around urban areas also play a major part in providing an experience that imparts a conservation message that is important in today's individualistic and consumerist society. This is despite the contention of Bocker (1991) that the public often perceive wildlife and the city environment as totally incompatible; nature conservation having been associated with the more natural, open landscapes of the countryside rather than with cities. Initiatives are being made to change this perception through provision of sites that act as interfaces between people and nature, particularly through the use of environmental education and interpretation. For example, the main purpose of the Blackburn Meadows nature reserve on the border of Sheffield and Rotherham is targeted at providing a 'nature' experience for local people in a socially-deprived community in the industrial heartland of the area. The Blackburn Meadows Trust has as its mission statement, *"improving the quality of life for people and wildlife"* (Cartwright, 2000). The study will examine the potential for formal access, visitor management, environmental education and interpretation at specific sites.

The legacy of pollution is one of large areas of contaminated land, poor air and poor water quality. The dereliction following decline in the area's traditional heavy industries (which were often sited alongside rivers for power and cooling properties) has opened up new opportunities for reclamation and regeneration, which can include, and may well be enhanced by, both nature conservation and recreational features. An example of this is the former Templeborough steel works which has as its backdrop the Blackburn Meadows nature reserve. This building once housed electric arc furnaces but has now been converted into the state of the art (and highly commended) Magna discovery centre for children based on the elements of earth, fire, air and water - crucial to steel-making.

1.4 Objectives.

* To critically review existing theoretical and empirical research within the field of study.
* To critically review national and international initiatives and guidelines alongside regional and local policies relating to land use in the study area.
* To document and describe the environmental, social and economic factors affecting wetlands in the catchment.
* To document existing and potential wetland environments and sites of significant size within the study area.
* To investigate what local measures are planned, have been implemented or are currently being implemented in relation to the stated elements of this study.
* To critically review the extent of the Environment Agency's Local Environment Agency Plan for the South Yorkshire and North East Derbyshire region.
* To critically review the Don/Dearne Green Corridors Initiative.
* To investigate particular issues and opportunities.
* To investigate ideal site selection criteria and compare them with those utilised for existing developments.
* In the light of the above, using specific case studies, to suggest amendments to regional strategies.

APPENDIX 4

FOCUSSED INTERVIEWS WITH KEY 'PLAYERS' IN THE CATCHMENT - NOTES FROM INTERVIEWS ('FACE TO FACE' AND WRITTEN RESPONSES).

Focussed interviews -

Local authority respondents.

Interview with Val Greaves (with additional comments from Simon Ogden), Planning Officers, Planning, Transport and Highways Department, Sheffield City Council. May, 2002.

Vision for the catchment.

No real vision other than the policies in the Unitary Development Plan (UDP) (1998) but all the river valleys are accessible to a limited extent and the Sustainable Urban Drainage Schemes (SUDS) are being heavily promoted. Currently there is a major review taking place for the UDP but there is likely to be little change in relation to the research topic area. However there are some major new issues to address:

* The promotion of SUDS in partnership with Sheffield Wildlife Trust
* Biodiversity Action Plans
* The overall provision of designated Local Nature Reserves
* A re-look at the 'green' network
* A push to enable more access to riversides
* Increasing flood risk and development pressures.

In terms of riverside access there are many physical barriers where previous development has built right to the river's edge and there are also security fears about allowing access on secluded areas.

Consultations on the UDP will soon take place with Yorkshire Water and the Environment Agency.

Development issues along riversides.

Upper Don	-	Remaining industry at Stocksbridge Steels (thought to be soon closing) and a graphite works at Claywheels Lane, Wadsley Bridge, Sheffield.
Mid section	-	The former Whitbread Brewery now being developed as high class of the Don housing - the river has now become a catalyst for development and is now a strong selling point.
Lower Don	-	There are still surviving steel works, engineering works and scrapyards that detract from more modern development such as new retail, leisure, finance and call centres. There is modern housing development at the Darnall fringe. The ongoing development of the Five Weirs Walk has aided development and provides valuable leisure and recreational access to previously inaccessible areas along the river.
River Sheaf	-	A river study is being conducted by Heeley Development Trust. There may well be riverside access opportunities in the redevelopment of the former Tyzack's engineering works at Heeley which will be business rather than retail or housing.
River Porter	-	No significant changes are expected.
River Rother	-	Not much in Sheffield but the Woodhouse Washlands nature reserve is helping with BAP initiatives.
River Loxley	-	The former Hepworth's furnace brick manufacturing site is programmed for possible mixed development of business and residential. However access is fairly poor and there is strong local opposition.

Links to communities and the voluntary sector.

Partnerships with: Five Weirs Walk Trust; Heeley Development Trust; Upper Don Trust; Hillsborough Development Trust; Sheffield Wildlife Trust.

Links to other agencies only occur when a consultation procedure is in operation.

There are links to other local authorities through joint bids for EU Objective 1 funding and in relation to cross border issues such as the dilemma of poor air quality and traffic problems at junction 34 of the M1 motorway.

In the Lower (Sheffield) Don valley links are developing with Attercliffe and Darnall Community Enterprises for opportunities in the Sheffield to Tinsley canal area.

Funding issues.

One of the best ways of achieving access, leisure and nature conservation objectives is through the use of planning gain when development is approved in these riverside areas. In the city centre there is the creation of riverside walks, litter clearance and open space creation by these means.

In relation to the air quality problems at the motorway the East End Quality of Life Project have secured funding for the Tinsley Tree Planting project.

New policy documents.

These include a Trees and Woodlands Strategy and a Parks and Countryside Site Categorisation Strategy.

Additional comments from Simon Ogden, a Sheffield City Council Officer but actively involved in voluntary sector initiatives on the Sheffield rivers.

These highlighted the following:

* That the Sheaf is "Sheffield's most abused river". He draws attention to a Strategy for the Sheaf Valley Walk in 1996 part of which has now been implemented through planning gain.
* That the role of the Environment Agency appears to be changing to one that is far more regulatory.
* In terms of addressing flood risk there is the potential to reduce the volume of water in the river system by 75% by allowing 'sponge take up in the uplands and to increase evapo-transpiration rates through provision of more vegetation.
* A policy that is difficult to implement from the Sheffield Nature Conservation Strategy and the UDP is that of deculverting streams and rivers where possible. This has been achieved at the Kelham Goit at a new housing development.
* The major problem with the rivers is in terms of bankside management as the EA are not responsible for litter clearance if it is not classed as pollution and there is no Sheffield CC responsibility here either.
* In recreational terms there is the possibility of bringing Peak District National Park type sports into the rivers of Sheffield City Centre with the creation of white water stretches for canoes, long-distance canoeing and with a link to the Ski Village at Neepsend. Water quality is the issue here along with bankside 'tidiness' but the inclusion of these types of activities could upgrade the image of the riverside for development.

Interview with Philippa Harvey, Countryside Officer and Kathy Hamilton, Countryside Planning Officer, Rotherham Metropolitan Borough Council. June 2002.

Strategic vision.

The Rotherham MBC ecologist is looking at something similar to Rother Valley Wildlife Strategy through the Don and Rother Stakeholder Group and in relation to the Environment Agency's Catchment Abstraction Management Strategy (Resource, Access and Management Framework).

Biodiversity Action Plan discussion need for Ecologists to have input to strategic planning.

Don/Dearne Green Corridors Initiative – difficult to see what it's trying to achieve.

Water Framework Directive – No influence as yet.

Rother Valley Wildlife Strategy.

Chesterfield Canal – Canalise section of Rother from Rother Valley Country Park to Rotherham town centre.

Ecological scoping study. (Mainly desk-top) - Out to contract (G1S database)

*Potential mitigation projects.

Also: -

Water Resources study and Archaeological Study

Unitary Development Plan review – Corridors, nodes, stepping stones, BAP implications.

South Yorkshire Forest money to map key habitats – distribution and quality.

Consultant – Producing report and G1S report – not complete.

NB RSPB got £800K (Heritage Lottery Funding) for sites along Dearne.

Possible wetland development on plant site – North East of Wath on Barnsley/Doncaster border next to former Wath/Manvers colliery. Very contaminated – urgent need to restore. On the Manvers site there is the possibility of development north of the lake.

Thrybergh tip possibilities.

Access – Major development of canal towpath

Dearne Valley industrial decline has resulted in traditional industry being replaced by Call Centres etc. but greenspace and access attached.

On the Eastern side of the borough area the land use is mainly agricultural with pasture alongside the river corridor. (Flooding issues – dioxins in the river are stirred up and deposited on pasture land)

Pollution – main problem was sewage but now much improved. Not aware of major issues except possibly road run off in the Dearne valley.

Existing sites of nature conservation value.

Woodhouse washlands nature reserve – some lies in RMBC administrative boundaries.

Forgemasters tip at Treeton now in RMBC control.

Along the river Rother – Blueman's Bower – Countryside Stewardship grant aided; Catcliffe Flash; Treeton Dyke; RVCP; Bolehill Flash opportunities?

Restoration of Orgreave opportunities (restoration plan not yetfinalised – depends on amount of available soil).

Flood Control issues.

Spoil needs depositing outside defined washland area if scrapes created; costs of disposal; contaminated soils.

Difficulties in putting sluices on outflows because these reduce capacity.

Partnerships - Groundwork Dearne Valley and Groundwork Cresswell; Environment Agency; RSPB; Yorkshire Wildlife Trust; Biodiversity Action Plan Forum; Chesterfield Canal Partnership; South Yorkshire Forest; Trans Pennine Trail Partnership; Some consultation with other local authorities particularly on cross-boundary strategies. e.g. Roth Valley Wildlife Strategy.

Strategic Thinking

Structure Plan Chapter 8 -

Environmental Policy 4 – creates Environmental Priority Areas (including River Rother and tributaries)

Any planning issues take into account the above and gain enhancement where possible.

Poolsbrook and Doe Lee (Derelict Land Areas).

No resources for enhancement at present. EU Objective 2 money in past.

Pick opportunities where arise, mainly through planning gain.

3 Valleys Project. – need something similar on South and East of Chesterfield.

Links to Countryside Agency – very little. (Some interest in rural N. East).

The Directors office (DCC) are part of an alliance of coalfields communities relating to economic regeneration.

Doe Lee – dioxins will be allowedto naturally flush out. At Wingerworth Coking Works there is a proposal to completely renew the river course through a £30m scheme. The development will be overseen by the East Midlands Development Agency. (Coalite Site).

Links to Environment Agency are through the CAMS Consultations - work at regional level now.

The landscape team at DCC are doing a landscape character assessment (using Countryside Character Areas and Natural Areas).

BAP 1997 – are being developed as Natural Areas definitions are coming in and therefore there are few revisions.

Constraints to vision

*** Resources ***

There is some possibility to take action on areas over which DCC have control mainly former derelict land sites but on other areas DCC have little influence.

Habitat management/access/private involvement all limited by lack of resources.

Local authorities work well together, for instance, three are affected by the River Rother and its tributaries.

District Councils have even less resources and don't have technical expertise.

Evaluation

Derbyshire Wildlife Sites are listed fro protection in environmental polices under Sites and Features of Nature Conservation Importance run through Derbyshire Wildlife Trust (DWT) – service level agreements with Trust (System in place since 1983 – but there have been many revisions).

Criteria for selection of sites based on BAP priorities (still in draft form). Old System based on 1996 handbook which was based on the Ratcliffe criteria. All sites mapped on GIS. In River Rother and its tributaries there are some of the best recorded sites with lots of data. (Some lack of passing on data from Derbyshire Ornithological Society to DWT).

Derek Whiteley's work on invertebrates in wetland areas and small mammal work.

The system used by DCC is seen as an effective good recording and selection system.

DCC reclamation sites in Doe Lee Poolsbrook R Valley – included habitat creation initiatives (Williamsbrook Country Park, Poolsbrook Country Park, etc). Significantly improved biodiversity but lots of wetland flashes lost.

Future – Need for management of existing sites, enhancement of some sites BUT there are no resources. Some sites declining in value for lack of management. However wetlands need less, but their surrounding pasture is declining and "impossible to manage", mainly through scrub invasion.

Rivers – Doe Lee, Poolsbrook and Rother - DCC don't have many opportunities to influence management or development as they don't have ownership of many stretches.

Several riparian owners have responsibility for a stretch of the Doe Lee at Glapwell.

Old Markham Colliery – Bolsover DC proposal to put M1 Junction in (29A) for the Markham Employment Growth Zone (MEGZ). DCC own the colliery site.

- Opportunities to maintain and enhance wetland areas in linear strip adjacent to Doe Lee.
- Link to other adjacent wetland sites South of Bolsover up the Doe Lee to Poolsbrook and part of Rother (cf. Dearne initiatives)

Regional money is available. Capital works out of MEGZ scheme as part of landscape reclamation. Includes Sustainable Urban Drainage Schemes.

The planning application may get called in by the government because it was not described in accepted local plans. There is some private ownership. The Highways Agency have given the go ahead to the M1 junction itself as yet.

Economic issues.

All the old industries have gone except for at Staveley and Bolsover. All Collieries have now gone. Most of the heavy industry on the River Rother has gone.

Redevelopment – "big sheds"

There are issues in relation to the effect on the landscape at the MEGZ site re location in relation to the visual impact on the view of, and from, Bolsover castle.

DCC strategy for hard and soft landscaping with briefs for individual plots – but may not be accepted.

Agricultural Management.

Flat areas in the valleys are mainly arable and thus some land does flood. Smaller, steeper fields seem to be out of production. Some increase in horticulture.

Increasing urban fringe problems – reluctance to keep livestock.

Green tourism opportunities for economic regeneration – awareness at all local government levels – need to improve visual appearance of area.

Several 'Walking for Health' projects in the area.

The move to improve corners of fields for the benefit of wildlife seem to be getting cut on economic needs.

Irrigation issues.

Irrigation is not needed.

Drainage issues.

Valley bottom fields are intensively drained.

Pollution issues.

Dioxins from Coalite, Bolsover (see earlier)

Wingerworth coking works (see earlier)

Diffuse pollution is an issue. There is also a rubbish issue, particularly with the appearance of the River Rother as it flows out of Chesterfield after a flood. Minewater is not major issue anymore – Some pumping (major) at Williamsthorpe.

Constructed Wetlands

Low key reedbed filters (not scientific) on reclamation schemes.

MEGZ proposal (see earlier)

Flood Control issues.

Flood events do restrict nature conservation opportunities, particularly in relation to past engineering thinking on moving flows through areas as fast as possible - Canalisation of Doe Lea and parts of the Poolsbrook.

There are no means of reversing this at present. But a benefit is that, if the stream is carrying pollutants then these are carried through and do not enter adjacent wetlands in time of flood.

Access issues.

People go anywhere.

Some areas avoided apart from birders – perhaps because they are private.

Controlled access is DCC policy and to maintain some currently unused areas. DCC try to improve linkages in order to generally increase peoples' interface with nature conservation but avoid sensitive/important sites. Initiatives for improved access include the Cuckoo Way and sections of the Trans-Pennine Trail.

Partnerships

Rother Valley Wildlife Strategy Group is "limping" – lack of available leadership,

but the Chesterfield Canal Regeneration coming on strongly.

Links have been very useful and still could be, but they are not needed on a day to day basis now. Partnership issues are becoming more strategic e.g. BAPS.

A recent fisheries seminar was extremely successful – people going away with some message.

The Countryside Service work closely with communities close by projects e.g. Three Valleys Project close links to DWT.

The exception is other departments within the council except the Countryside Service who liaise with the Education Department etc., but links to the Highways Department etc. is poor.

Funding.

The New Opportunities Fund 'Wildspace' for Local Nature Reserves through English Nature would be perfect for MEGZ area but it has just run out of money!!

Documents of relevance.

Derbyshire Structure Plan

Countryside Strategy is being rewritten

BAP – Lowland Derbyshire BAP – have a document but limping badly – no co-ordinator – no-one has time to push implementation.

The Derbyshire Nature Conservation Strategy is out of date (more than 10 Years).

Notes provided by Phil Tierney-Kitchener, Countryside Officer, Barnsley Metropolitan District Council (based on reports by C. Needham, Amateur Ecologist as a consultancy for the Environment Agency).

Rehabilitation of the River Dearne Corridor for the Environment Agency (EA), 1998.

The report identifies
- individual EA sites for environmental improvements
- the recreation and conservation value of the Dearne Valley
- types of environmental improvements most suitable for the area
- possible partnerships

There are large tracts of washlands for floodwater storage in Dearne Valley.

Six sites have been identified alongside other improved areas:

- Dearne Valley Park (Barnsley MBC)
- Grimethorpe Colliery (English Partnerships)
- Edderthorpe Ings (Barnsley MBC)
- Cudworth Washland
- Darfield Bridge
- Broomhill Flash (YWT)
- Wombwell Ings
- Old Moor Wetlands (BMBC)
- Wath Ings
- Manvers Lakeside (RMBC)
- Bolton Ings
- Bolton on Dearne Riverside (Groundwork)
- West Moor Closes
- Denaby Ings (YWT)
- Earth Centre.

"The distinctive feature of the valley is not only its important wildlife conservation value but also in its strategic position as a green corridor running through highly populated areas."

Projects.

Earth Centre — Phase 1 - £34 million (£30 million from Millennium Commission still available after this but requires matched funding) over 450 acres

Manvers Lakeside 50 acre lake - Landscaped surrounds and Golf course

Old Moor - WWT original Partnership involvement but lured away by London developments (Barn Elms)

Visitor numbers expected to match Martin Mere nature reserve eventually (150-200,000)

The Dearne valley has strategic significance in relation to access and its position "in an area where there is no other such facility in Yorkshire or the North Midlands." A road building programme is underway in the valley, creating the Dearne Valley link road from the valley to the A1 and M1.

"It is important to connect environmental policy with the effects this has on employment planning. The 'greening' of the valley complied with enterprise zone requirements and greater means of access has already proved attractive to industry. It would be difficult to assess the effects of environmental improvements on the economics of the Dearne Valley".

Evidence in estate agents of the use of Wombwell Ings as a positive selling point.

The valley holds locally and nationally important bird species and numbers. In the 1960s and 70s there was massive destruction of important natural habitat along the Dearne Corridor, caused principally by drainage and the tipping of Colliery waste. Isolated pockets of good wetland habitat have survived – Denaby Ings, Wath Ings.

YWT Interest in the corridor - Broomhill Flash; Wath Ings; Denaby Ings

They identify that the most pressing need is for agricultural change.

Groundwork interest - Environmental improvements around Bolton upon Dearne.

English Nature interest

"The most striking features to emerge from an analysis of the Dearne Valley is the string of wetlands, open waters, marsh and wet grasslands linked by the river, and the fact that these are not only important habitats in their own right, but support a wide range of species."

The Environment Agency have the control to improve management and undertake capital works in valley.

Barnsley MBC interest

Policies in the Unitary Development Plan provide strength to protect nature conservation interests within a green corridor. ***"The River Dearne will always be a significant feature of the council's activities."***

1997 – Discussions with EA to identify opportunities for action tied to funding for studies which will identify proposal opportunities and site limitations. Link to minerals planning.

Old Moor – Establishment of independent trust based at Old Moor Wetlands Centre.

English Partnership Interest - Core business – Urban reclamation of derelict land to secure jobs.

They will support environmental improvement schemes but ***"they have to have an impact on local communities by the improvement of the environment and an increasing the potential for investment in the area."***

Potential problems of implementing environmental improvements –

* In the last ten years the EA has significantly improved Dearne water quality.
* Obstacles – Land use changes; arable farmland; financial incentives for development

Barnsley UDP

Economic Development

Traditional industries – Coal mining, glass manufacture, clothing manufacture. Employment declined rapidly in last 10 years. Mining left Barnsley with large areas of derelict land. Economic development and employment creation became the leading priority for Barnsley MBC. The UDP focuses policies on the amount, type and location of land for development and on measures to support existing industrial and commercial development in the Borough. ***"These policies and proposals are based on a balance between the sometimes conflicting, but ultimately complementing, goals of re-industrialisation, environmental protection and enhancement in order to achieve sustainable economic development into the next (21st) century."***

Environment and Recreation.

Planning Policy Guidance Note 12: Development Plans and Regional Guidance. - Covers traditional issues such as Green Belt, landscape and nature conservation, together with new issues such as the links between C02 emission and power generation and transport with global warming; Sustaining the environment for future generations and conserving non-renewable resources.

Pressures - rising demand for recreational activities on proposals to diversify rural economy, for example; appropriate greenspace: commercial, industrial, leisure and tourism development; housing and economic development; renewable sources of energy (windfarms?); mineral working partic opencast and waste disposal

Rural - need to protect and enhance valuable conservation areas from inappropriate development. Balance against need and increasing pressure for leisure recreation, mineral working and diversification of rural economy. Current Government policy is to concentrate on protecting best and most versatile land and to encourage diversification.

Urban - need to strengthen and extend protection and enhancement policies to valuable open land within built-up areas is becoming increasingly important as its importance to local communities is recognised and it is

acknowledged that development of this land is generally irreversible.

Greenspace - protect key environmental resources to contribute to objectives sustainable development; reclaim derelict land for new development where sustainable and feasible; comprehensively improve major tracts of derelict, despoiled and neglected land in urban areas and provide open space and recreational facilities; improve physical environmental in industrial and commercial areas and along main roads; improve the physical environmental in housing priority areas – particularly in unpopular areas; protect the open character of land around and between settlements; protect and enhance areas of high quality landscape, nature conservation and archaeological significance; protect and enhance the network of green corridors linking urban and rural areas; protect valuable areas of open space within urban areas; improve the quality and provision of open space within urban areas; protect and enhance the provision of indoor and outdoor sport and leisure; increase the extent and quality of tree cover in the Borough; maximise opportunities for community and individual environmental involvement and action; maximise public access to, and awareness of, recreational open space; protect the best and most versatile agricultural land while allowing appropriate diversification.

Culverting and canalisation are seen as a major threat to wildlife habitats and amenity of greenspace. Under policy GS15 *"Development will not normally be permitted which may destroy of adversely affect the integrity of wildlife corridors."* Barnsley MBC are committed to promoting the re-opening and restitution of existing culverts and canalised watercourses. Policy GS16 states that *"The council will seek to increase the number and quality of nature conservation interest available for education and general public enjoyment, whilst minimising detrimental effects and protecting sites from any potential damage."* Old Moor nature reserve is quoted as an example.

Policies on access, sport recreation.

R.H. Cuthbertson and partners (Leeds) (1999) have conducted a feasibility study for EA North East Region, into the creation of wetlands on the River Dearne washlands system.

Dearne Valley Partnership (1996) Old Moor Wetland Centre Marketing Plan published by Barnsley MBC.

"The innovative scheme (Old Moor) will transform a derelict area into a wildfowl and wetlands reserve as a major gateway site to the Dearne Valley and Wath Manvers. It will play a dual role in contributing to the regeneration of the area both as a major environmental improvement scheme and as a tourist attraction."

Local Market Data (1995 census): -

Barnsley	226,700
Rotherham	255,800
Doncaster	292,900
Sheffield	528,500
Wakefield	317,100

TOTAL	1,621,000

E Bennett (1999). Old Moor Wetland Centre Man. Plan published by Barnsley MBC

- Grid ref: SE 422022. Six miles east, Barnsley centre. 101 hectares.
- Tenure – Ownership and leasehold (from EA) areas – BMBC

Old Moor funding:

-	EU RECHARII	£373,119	Measure 2
		£101,851	Measure 4

Interview with Martin Nowacki, Head of Countryside Team, Doncaster Metropolitan Borough Council.

Spring, 2002.

Strategic vision.

Now that EU Objective 1 funding for South Yorkshire area is available the South Yorkshire Forest team, who administer the environmental project funding the original Forest boundary has now been increased to the Objective 1 boundary i.e. South Yorkshire and thus now includes Doncaster. Two posts (SYF) funded by Objective 1.

The railway corridor through Doncaster is dismal from an aesthetic point of view. Mainly following the River Don Valley it takes travellers through industrial and derelict areas but there are visual aesthetic breaks such as Old Denaby Wetlands. This travel experience is not surprising considering the socio/economic history of the area.

Quality of life – things must run hand in hand. There is lots of money for reclamation, but how vulnerable is a nice environment to having a job?

Countryside Stewardship – targets now getting too tight in terms of economic benefit – many and may not be renewed. Margins do not now show a good return.

Marginal land Set Aside could be used for flood containment – nature conservation interest.

Can this be identified? This is a question for the Environment Agency.

People have little perception of the ebb and flow of rivers. (Even with the tidal Don). People think you can control rivers.

Doncaster SSI Survey – Re-looked at within last 5 years.

- Digitised survey
- Land use survey

Thorne Moor - 3/5 in Doncaster

- 2/5 as Crowle Moor in North Lincolnshire.

Criteria for site evaluation depends on its end use. There is a local authority commitment that it is important to give people close and immediate access. Critical natural capital (constant). Stock natural capital.

Potteric Carr nature reserve is looking to divorce from YWT.

It is hoped to develop an Environment Centre at its entrance which would house:

- Don Co. Service
- Potteric Carr Trust
- YWT
- BTCV (from Balby)
- Groundwork?

Box and Harrison Criteria:

- Greenspace Audit Final Report Dec 2001
  (Directorate of Development and Transport,
  Greenspace Strategic Services).
- Greenspace Strategy Consultation Draft January, 2002.
  - Borough Strategy, Local Government Act 1999
  - Land Use Survey.
  - Local Development Framework.

Trans Pennine Trail - Old Moor; Denaby Ings; Earth Centre; Sprotborough Flash; Sprotborough/Hexthorpe Ings; Crimpsall Sluice (Tidal Boundary); Oxbow reconnected; Old sluice set at one level - One end rock shoot – acts as fish pass which old sluice prevented – Salmon now can access further up Don and into Dearne. Demonstrates soft engineering techniques.

Wetland creation at Thorpe Marsh power station.

Old Denaby - NVC Report - Conservation grazing? but fencing 'nicked'.

Ferryboat Lane Fisheries – Bunding created following floods.

Doncaster SSI Survey (Digitised survey/land use survey) Aerial Survey Greenspace Audit Greenspace Strategy Borough Strategy (Local Government Act, 1999) Sports Strategy Land Use Survey Local Development Frameworks Trans Pennine Trail (Map?) Old Denaby NVC Report Flood Photographs.

Environment Agency questionnaire needs to include: Fisheries; Flood Control; Navigation; Relationship to DEFRA

The Local Authority has no plans for river/wetland development.

Tension re fisheries between British Waterways and EA

BW want financial return/EA protecting river environment.

Trans Pennine Trail on new Junction Canal. BW conditions extremely rigorous but development plan talks about access etc.

Levitt Hagg stretch of Don – BW own river bed, Doncaster MBC own bankside – problems over licensing fishing.

'Cruise the Don' river trips twice per annum - Different View - Interpreted (Historical and Environmental)

Doncaster mainly class 2/3 agricultural land (Mainly arable pastoral in North EastDoncaster).- Near Thorpe Marsh – subsidence – looking at planned retreat.

Habitat creation – More future in agri-environment schemes. (Arable option in Countryside Stewardship).

Coal – Gone but still in Rossington, Hatfield (UK Coal). One mothballed at Thorne.

Peat – Going.

Links between countryside and socio/economic – Local Authorities don't want to know other than access.

* Internal Drainage Boards – David Patrick (Grantham, Brundell and Farrand Consulting Engineers. – Agents for all drainage boards) 01302 342055.

Blackshaw Clough Scheme – takes in area around fishlake – Drains large area around Fishlake – but now difficult to get schemes through – Needs Environment Impact Assessment and cost/benefit analysis.

Pollution

Small industries creating pollution events now rather than large events of past. Mineworkings in Doncaster deeper BUT when is minewater seepage likely to occur?

Very little communication between riparian owner and EA flood defence.

Access is one of main thrusts of Donc. Co. and prow. Service – TPT.

Partnerships – Would like better relationship with YWT (encourage them to *"climb out from behind battlements in York"*. Sub regionalisation potential) and possibly RSPB.

Community partnerships – Wetland sites increase liability therefore difficulty to share responsibility and liability.

Countryside Agency – No-one knows what they're about.

English Nature – Restrictive.

Department of the Environment, Food and Rural Affairs. Since Countryside Stewardship has moved to MAFF/DEFRA there is a much more professional attitude.

Other Authorities – little co-operation at political level, at officer level it is marginal.

Other departments in authority – when needed. (No-one wants to know about rivers).

Funding comes through community initiatives. Trans Pennine Trail – development funding – no revenue – mostly millennium funding.

Focussed interviews -

Respondents from government advisory / regional influence organisations.

Interview with Stuart Pasley, Senior Countryside Officer, Countryside Agency, Yorkshire and the Humber.

February, 2003.

Introductory comments.

The East Midlands office of the COAG cover the Peak District sector of the Don catchment but the Yorkshire and Humber office have influence. However, the Yorkshire and the Humber office would lead on catchment issues.

The '*Countryside Character*' areas are not affected by administrative boundaries e.g. The *Humberhead Levels*.

The magnesium limestone *Countryside Character* area (which includes the Don Gorge) is led by Groundwork Creswell. A bid has been made for Heritage Lottery Funding which is nature conservation focussed. The Coalfields *Countryside Character* area is led by the Yorkshire and Humber office with input from the South Yorkshire and White Rose Forest teams. The change from former derelict industrial areas to the promotion of 'forest' backdrops to new industry is seen as crucial.

The Countryside Character designations provide a good basic structure but the boundaries do not assist in catchment planning. For example the *Humberhead Levels Countryside Character* area crosses nine catchments. This creates confusion for the Environment Agency who need representation on such initiatives as the *Value in Wetness Initiative* - do all nine catchments send representatives or how is information gleaned by them disseminated?

The Water Framework Directive is catchment based but perhaps it needs something more.

Don/Dearne Green Corridors Initiative.

In theory it is hoped that the common framework put in place will be used by local authorities.

The initiative focussed on huge areas of regeneration with an aim to improve coordination (particularly in terms of 'soft' landscaping). The COAG are waiting to review how this is working. Currently aspects of the initiative are being operated by the South Yorkshire Forest team and Groundwork Dearne Valley.

The COAG are not recommending the use of Project Officers as these are too costly, but how do you implement the project without them? It is hoped that a more private sector approach will develop. The downside of having no Project Officers is that there is no focal point and no direct operational control.

The *Rivers Trust* approach in SW England is a hybrid driven by the private sector with public sector involvement.

Feedback from the *Humberhead Levels Value in Wetness Initiative* gives the impression that landowners are appreciative of the approach which does not dictate policy from the EU or DEFRA.

Relationship of the Don Catchment to the *Humberhead Levels* and pollution issues.

The Don provides a direct link for opportunities associated with recreation and tourism. But problems arise as to links outside the Levels area. There are corridor links to the major cities in the region but these bring with them associated issues particularly in relation to them acting as the conduits of pollution to the Humber estuary and the fact that this is the major source of pollution of the North Sea. If this is a priority then it may provide resources for reedbed filters to be developed along the conduits and in the estuary.

The Royal Holloway Institute is looking at wetland pollution control systems and particularly in terms of agricultural run-off. They are concentrating on the strategic ditch network which has flood defence, drainage, historic, nature conservation and water quality aspects. At key points in this network they are looking to propose wetland development to fulfil these objectives.

Discussions are taking place with the Finningley Internal Drainage Board in relation to bio-fuel opportunities from willow coppice and energy grasses (reed canary grass) production. This integrates land use objectives but with a bonus of economic benefit although this is at differing scales.

A further potential initiative is a '*Source to Sea*' long-distance trail from the source of the Don in the Pennine hills to its link to the Ouse and the Humber estuary. This could be promoted by the Humberhead Levels Green Tourism group who already promote a circular 'Peatland Way' which is locally funded.

Strategic policy.

The whole purpose of the Humberhead Levels Initiative is to integrate various existing policies and strategies. The intention is to help to deliver the vision of other agencies and individual farmers.

CoAg are pushing for recognition of the implications of climate change, the Water Framework Directive and reform of the Common Agricultural Policy, and to question how these can be prepared for and how they can be turned into advantages and opportunities. These are fundamental to the *Humberhead Levels*, particularly in relation to water management initiatives where these are critical.

DEFRA's '*Directing the Flow*' document on water resources has good content but suffers through lack of consultation either pre- or post-publication.

The Humberhead Levels core group consists of CoAg, EA, EN, English Heritage and Grantham, Blundell and Farran (representing the IDBs). The group has a coordinating role but has not reconvened since Foot and Mouth Disease restrictions. The link of the CoAg is stronger to EN and EH than to EA. The group is currently working on a single set of environmental guidance notes for integrated management.

Water Framework Directive.

DEFRA and the Environment Agency are working centrally on the implications of this but not much is being disseminated out, particularly to individual stakeholders.

Constraints and barriers to progress.

Institutional:

* IDBs remit and operations. (There is a real need for water management boards because the IDBs only operate to a single set of objectives).
* Flood management - there has been a historical preference for hard engineering solutions with the EA not having the concept of multiple objectives or that these could be achieved by doing things in a different way yet still preserving adequate flood control. The lower Don catchment has huge potential for integrated management developments and current thinking on this area and the lower Aire is very positive. But the EA tends to be focussed on individual projects with no strategic underpinning.

Site identification.

The RSPB are conducting a wetland audit in North Yorkshire and the CoAg would like to extend this south of the Humber but there is no real work on this by CoAg other than some sample areas for water management work in the Levels and from the research work done by the Royal Holloway.

Key industrial associations.

In the Levels there are two key areas - agriculture and water transport.

Agricultural land value is high as would be expected in an alluvial deposition area where the soils are highly productive. Crops grown in the area are not necessarily subsidised and therefore there is not much leverage for changes in management practices. For instance, there is no influence from The EU Cross Compliance Regulations. Because the land is so productive agri-environment schemes (e.g. Countryside Stewardship) are not economically viable. Much research work has been done on the recreational and tourism potential of the Levels (Ian Rotherham and Simon Doncaster). Economic drivers are being identified that can move land management towards improved water management.

Drainage issues.

In the Levels this is a major issue with considerable discussion with several IDBs.

The importance of the archaeological resource must be noted and how this could be affected by drainage and consequent drying-out of the landscape and the preservative medium of the wet soils.

Pollution issues.

The national view is that point source pollution is steadily being addressed and that diffuse pollution is now the greatest proportion of problems. Addressing this is a key objective for the Levels.

Piloted Positive Water Management initiatives in the levels will give anecdotal accounts of where there are problems. The focus of CoAg will be on ditch systems but the question is whether the IDBs do any water quality monitoring or assessment of these. Research has been carried out on water quality at Sutton Common site of archaeological interest and new research will look at a broader range of sites.

Flood issues.

The Askern Community Development Officer has a vision of the Levels as something like the Norfolk Broads in his area. Linked to increased water levels are small-scale economic development opportunities such as the potential for boat building at Thorne, a former historical inland port of significance. EU Objective 1 funding for training may be available for these sorts of issues. CoAg would like to see an emphasis on managing floods rather than (usually unsuccessfully) trying to control them. Additional objectives in this respect may be needed in the Levels.

Access issues.

The research by Rotherham and Doncaster mapped footpath density in the Levels and found access to be fairly poor and that the condition of those found was also poor, particularly in the arable areas. But it was also identified that people appreciate water and like access beside it. Area access planning will include footpath structure and links to public transport.

Partnerships.

The Humberhead Levels Initiative is an exemplar of a good partnership with extensive stakeholder involvement. The constituency of the *Value in Wetness* conferences enables information to be passed and exchanged and for people's points of view to be heard.

There is the already mentioned partnership with the Finningley IDB looking at bio-fuel production.

Partnerships with the community include:

* Vital Village programmes - a national initiative
* Parish Planning (which is linked to Vital Villages). This tends to focus on social and economic issues but CoAg are encouraging discussion of environmental issues. Some parish representatives attend the *Value in Wetness* conferences.
* Community Strategies are being produced by Strategic Local Partnerships.

Other partnerships include:

* Joint research with the RSPB about bio-fuel potential
* Wildlife Trusts re their ownership of a pilot site for *Positive Water Management*
* Feeding back the lessons learned from *Land Management Initiatives* (such as that at the *Humberhead Levels*) to DEFRA.

Funding issues.

* CAP reform and the move to area-based payments
* Greater emphasis on rural development issues
* *Land Management Initiative* provides advice.
* Flood defence budgets - need to expand objectives
* IDB budgets - water management strategies are not yet complete - even SSSI areas support *status quo* rather than positive change. The IDBs revenue support comes through the drainage rate. Capital funding has already damaged other interests so there is no leverage through funding to get positive objectives.

Policy documents.

Catchment Abstraction Management Strategies Strategic Flood Defence DEFRA's 'Directing the Flow'

Regional Planning Guidance - (note Flood Risk topic paper 7, Climate Change topic paper 6 and others)

Urban fringe policies currently being reviewed

Interview with Chris Firth, Fisheries Officer, Environment Agency, North East Region. February, 2003.

Introductory comments.

Despite rumours to the contrary the LEAPS (Local Environmental Action Plans) still exist and the key targets are still being aspired to. The Environment Agency centrally has a vision statement that each of the regions puts into a local context. The overall aims of the vision (selected as being of particular relevance to this research study) are: A better quality of life; an enhanced environment for wildlife; limiting and adapting to climate change; assessing flood risk; a greener business world; improved and protected inland (and coastal) waters; wiser sustainable use of natural resources; restore protected land and provide healthier soils

In terms of policy and process management a tighter central control was developing to achieve a better level of consistency in the organisation. This will help in identifying how local decisions and action fit into the national context. Overall there has been a general realisation of added, mutual benefits of working together.

Practical issues.

The Dearne valley scheme to enhance the wildlife and fisheries interest of the river was the first in the region to address the detrimental effects of canalisation. In 1995 it cost £6,000 to £7,000 per year to dredge the canalised sections and there were ongoing problems of erosion at pinch points where the channels could not cope with growing flow levels as a result of increasing upland drainage, agricultural land drainage and increasing run-off from expanding urbanisation.

The period between 1934 and 1951 a major section (2 kilometres) of the Don was canalised from Doncaster to the Dutch River at Rawcliffe. One of the consequences of this type of engineered realignment has been that the water flows far faster and that has resulted in erosion problems. The water has scoured the river bed down 2.2 metres and is now almost through the clay layers. On the stretch created Vermuyden the river banks and the adjacent road are collapsing.

Coal mining areas created wetlands in the form of subsidence flashes and since the demise of the industry many of these sites cannot be developed so it has been accepted that they remain as wetlands.

Water Framework Directive.

The relevant designated River Basin District will probably be the Ouse catchment and then sub-divided, but there are concerns as to how the importance of local issues will be dealt with.

There is little recognition of where the funding will come from to implement the WFD.

Fisheries issues.

To be effective salmon passes at obstructions should be implemented at the top of the catchment and then work downstream. As fish spawn in the upland stretches to start at the downstream end would be to attract the fish but leave them nowhere to go. There may be planning gain opportunities but these would be piecemeal. The strategy to have spawning game fish must include the whole river system and there are hundreds of obstacles to overcome. This would make the exercise incredibly expensive.

An interesting development of the ongoing improvement of water quality in the system is that, if this continues, then a change to a system that suits trout and salmon would penalise coarse fishers. There would also be implications for bankside access restrictions. The 'policing' costs of protecting fish would be enormous.

Consultations.

The Agency is involved in the consultation procedure for Local Strategic Plans where there is a need for local interest and understanding. Because of lack of staff resources only 50% of such consultations can be resourced. The Agency is also very involved in implementation of the EU Habitats Directive.

LBAPs involvement is very *ad hoc* and very limited: No formal arrangement; No resources for more involvement but will provide support, advice and information.

However, the Agency is the lead partners in some EU Species Directive initiatives with an accent on protection measures. But there is no time to be pro-active.

Restoration/creation initiatives.

These were primarily funded from the fisheries budget between 1994 and 1998:

* River Rother - creation of a rock weir in Rother Valley Country Park - this allows natural cleaning and scouring of the river bed for barbel, chubb and dace.
* River Dearne - de-canalisation of the river adjacent to Old Moor nature reserve.
* River Don - connected Sprotborough Flash to the river - allows effective and beneficial water level management (£50,000 spent on intake structure).

These initiatives were undertaken when this part of the Agency was the National Rivers Authority. When the EA needed external support to justify resource allocation there was no financial expertise to identify and apply for funding from the EU, HLF, *etc.* However, an external funding officer has recently been appointed for the region.

Current projects.

Crimpsall Sluice fish pass on the River Don has been completed from the flood defence budget.

River Dearne initiatives are almost complete. Staff have been working for six years to try to create wetlands down the valley. Leases are in existence on EA land in the valley for agricultural purposes. Partnership with RSPB to expand conservation interest at Old Moor into these sites by a partnership to buy out these agricultural interests and then create a "necklace of wetland jewels" along the valley. This process should be complete in 2 to 3 years.

At the Orgreave opencast site and its restoration the River Rother has been realigned with meanders to create a gentle, slow-flowing river through the site. A rock chute fish pass, similar to the one at Crimpsall Sluice will be created in the system.

Flood defence and potential projects.

The most difficult area to address is the physical problems on the Rother, An idea for a project to bid for funding to re-meander the river and develop further wetlands at Woodhouse Washlands nature reserve never happened. It requires a partnership bid from the Yorkshire Wildlife Trust, the EA and Sheffield Council to resurrect the project. Although this might have been expected, disappointingly there are no real wetland or river developments at the Earth Centre project adjacent to the Dearne.

Most opportunities for restoration and creation lie on the Don and particularly on the Doncaster to Rawcliffe section, through opportunities provided through the Flood Defence Strategy. Following the major floods of autumn, 2000 flood levels were re-assessed for each river. This would cover modelling for both water management and flood defence. For the Don it had been assumed that the 2000 flood was near to a 1:100 year flood but under re-examination in greater detail it was found that this was a 1:50 event despite the enormous devastation. The river almost breached in the Fishlake/Sykehouse area which would have devastated agricultural production but there was also a near breach near Doncaster where hundreds of thousands of properties would have been affected.

(NB. A 1:100 year event equals a flow rate of 340 cubic metres per second, and a re-evaluated 1:100 year event equals a flow rate of 400 cubic metres per second).

The south bank of the Don breached at Hatfield and Barnby Dun was under water.

The re-look came to the conclusion that it was necessary to get water through Doncaster as fast as possible but there was an additional problem of what to do when flood flows meet a rising tide downstream of the town.

The opportunities that arise from the concern over future flooding mean that high grade agricultural land is now being looked at with a view to compulsory purchase to create flood containment cells (flood plains) on the north side of the river. It is estimated these could cope with a 100 year flood on a spring tide. The cells would quite possibly need the containment embankment to be created up to 1 kilometre from the river as double the present capacity is needed. An enormous amount of material would be needed to create these embankments and this would be dug out of the land contained and thus create wetland areas. The possibilities for created areas could include:

* Open water areas for: Nature reserves; irrigation water (especially near the River Went); designed for recreational use
* The creation of a secondary channel downstream of Stainforth to link to Fishlake (which was a medieval port). This would almost follow the old route of the River Don and could be navigable thus creating commercial opportunities.

Drainage.

The EA has no great contact with the Internal Drainage Boards. These vary greatly in their attitude to conservation issues but there has been a cultural change over the last seven or eight years. They don't seem quite as remote.

Pollution issues.

There are no major pollution issues now but there are opportunities to create buffer or barrier strips along the water courses of the River Went where there are eutrophication problems from chemical seepage and over spray on agricultural holdings. There are also opportunities to involve farmers in the initiatives on the Dearne, perhaps through FWAG.

Acid mine seepage has been a major problem but the main site at Bullhouse has been put on the national priority list for remedial action and the subsequent works have been 90% successful. There is still a problem just upstream of this site where a small stream has become more ochrous, perhaps through back pressure from the new plant, but it is only a minor problem.

The major issues to do with sewage works outflows are now being remediated at the local level, for example in improving balancing systems and screening at Combined Sewage Overflows. The big restoration schemes as at Blackburn Meadows Sewage Treatment Works are now finished and have made a huge improvement to river water quality. However, one site on the River Rother at Avenue Coking Works is causing concern because of its coal tar legacy. There is a need to remove sediment without disturbing the developed ecology.

Another site causing concern is the residual from the former moth-proofing works on the River Dearne below the Clayton West sewage works. The fish populations are way below what should be present.

Flood defence.

The Flood Defence Strategy is not in any complete form and there is not much yet to consult on.

Final comments.

The LEAPs became 'wish lists' without consideration of reality and there were also problems with changing legislation. They are no longer working documents but purely for reference.

Interview with Tim Kohler, Conservation Officer, English Nature, Humber to Pennines Team. March, 2003.

Links to the work on '*Natural Areas*'.

Broad statements are made about what to do with river systems. Connected to this is the fact that links are being mapped between habitats - rivers represent natural corridor links. There is no cohesive vision for river catchments other than these broad statements. However, there is a dedicated wetlands team at EN headquarters. EN committed to working with the Environment Agency in strategic catchment planning but the situation is somewhat confused at the moment with changing emphases. However, EA have employed a consultant to work with EN and EN is being consulted on flood defence works. Problems in communication between the two organisations are exacerbated by the fact that regional geographic administrative boundaries of the two organisations are very different. For example the EA administrative boundary between two of its regions runs through the middle of the Thorne and Hatfield Moors complex. Equally, there are issues within EN with regard to boundaries as the Don catchment is covered by two different internal teams.

In 1993/94 the Regions were no longer an administrative unit as the area covered was split into teams. However, there is now a move to link boundaries to those of the regional government offices.

Constraints and barriers to strategic decision-making and implementation.

* Communications and resource issues: No new money; reluctance to increase staffing levels and thus cannot do things would like to do (this could be a major issue if additional work related to the Water Framework Directive comes in); constant stream of new things to do (the basic workload for the teams is to monitor SSSIs and to meet DEFRA's 95% favourable/unfavourable target for recovery by 2010 - this tends to overwhelm all other work).

Community involvement.

This is a 'black hole' for resource allocation. Work on local Biodiversity Action Plans is very time consuming (but this has now been designated as a lower priority for officers' work).

Work loading.

The constant focus on local special sites means that strategic work is redirected to Head Office and thus tends to lose its regional and local emphasis. For sites other than 'special' sites EN is interested but cannot dedicate much time although local biodiversity work can identify sites that are particularly important in land use planning terms. Much of the work EN carry out to assist with local biodiversity issues is at the species level although some work on habitats has been done on the Rotherham to Chesterfield section of the Chesterfield canal. Significant time is also being devoted to a proposal to make the River Rother navigable and, although this is resource-expensive for EN significant damage could be done to habitats and species and thus it is seen as an imminent threat that needs attention. Proposals for canalisation would ruin work recently done to improve habitats and fisheries.

Site criteria.

There are no fixed EN site criteria to identify 'second tier' sites but they do use SSSI criteria for this but not as rigorously. Identification of social criteria has been attempted but has been found hard to quantify and not easy to apply. In terms of site criteria for Unitary Development plans the four South Yorkshire Biodiversity Action Plan groups are currently trying to devise a unified system.

Restoration issues for EN.

The local team are currently involved in advising on restoration schemes at former coalfield extraction sites at Orgreave and on the Rother Valley Country Park extension at Pit House West, but nothing coherent has yet developed. The project at the former Grimethorpe colliery has proposed extensive wetlands.

At Thorne and Hatfield Moors problems exist in looking at management of the peatland site as (already stated) the boundary of two EN regions transect the site. Another problem is that there is some drainage of the site to the River Don (Dutch River section). Priorities are to:

* Stop mining of peat
* Have an ongoing restoration plan
* Link to local communities to develop: Local economic opportunities; 'green' tourism opportunities; educational potential.

Monitoring must be maintained as restoration and management increase the wetness of the site and the impact this will have on local agricultural interests in terms of 'extensification' opportunities and a return to pastoral management which could enhance wildlife value. The importance of buffer zones around the site must be recognised and prioritised.

Information, advice and encouragement in relation to this can be promoted through the *Value in Wetness* project of the *Humberhead Levels Initiative*. Prospects for farms with higher water levels include: 'Green' tourism potential; shooting ; bio-fuel development; oil production (bio-diesel from oil-seed rape); alcohol based fuels.

Access issues.

Access to Thorne and Hatfield Moors is extremely poor resulting in a large cultural feeling of exclusion. Thorne colliery will not reopen as a working colliery but the land has been sold but there is potential to create further access to the Moors. The impact of the CROW Act will impact on this area which clearly fits the access criteria, but the area is surrounded by agricultural land with no access through. The CROW Act enables local authorities to do something about this.

Pollution issues.

The main difficulty in the area (Thorne and Hatfield Moors) is aerial in terms of sulphur and nitrogen generated from several local power stations, but there are new targets to reduce these levels. A future problem in terms of aerial pollution may arise from the development of the former Finningley RAF base into an international airport. EN provides *ad hoc* support to reduce river pollution.

Flood control.

EN provides support to the Environment Agency for flood control measures in the lower Don catchment.

Partnerships.

Yorkshire Wildlife Trust - problems in that they have a lack of resources to do anything outside their reserves.

RSPB - plenty of scope to work closely together in the Don catchment (and particularly the Dearne valley) but there is, as yet, no cohesive partnership.

Rother Valley strategy group - Only a peripheral involvement as most of the area lies outside the team's boundary.

Aire and Ouse partnership model - is very productive and could be used for the Don catchment.

Don/Dearne Green Partnership - appears to have 'died a death' but officers were never sure in which direction the initiative was going. The local authorities involved have not developed decisions from the group and it would appear they never really 'bought into' the project. Any results or decisions were vague and hard to apply. However, EN's view is that it could be resurrected as long as there were project champions with identified resources.

Introductory comments.

The South Yorkshire Forest is the only project that addresses cross-boundary issues and it provides a major strength for the economy and life in the South Yorkshire area.

Economic strategies.

Although the focus of the research is towards the influences of nature conservation sites SYF recognise that nature conservation *per se* is not a major factor in economic development but specific factors make specific surrounds important. However, 'rarities' are not significant in this respect. A well kept attractive setting provides a 'landscape benefit' for economic development.

Initiatives in respect of this include:

1. A corridor study of nature conservation in the Dearne valley by the RSPB to:
   - identify existing and potential nature conservation sites;
   - quantify how these can contribute to the economic value of the region.
2. A joint project by the South Yorkshire Forest team, the West Yorkshire Forest team and Yorkshire Forward to examine the factors that create a setting for investment by:
   - cataloguing and mapping investment sites;
   - conducting a landscape assessment.
3. A review of the Regional Economic Strategy by Yorkshire Forward.

Funding issues.

With the South Yorkshire region now eligible for EU Objective 1 funding The SYF team is responsible for administering grant aid under Priority 4B measures 25 (Developing Forestry Resources) and 26 (Broadening the Agricultural and Forestry Skills Base).

Measure 25 aims to, *"develop forestry resources in South Yorkshire in a sustainable manner, providing environmental and social benefits for local communities, to encourage investment and create new employment opportunities in forestry and related industries".*

Its objectives are to: Develop a viable and sustainable forestry industry; improve the ecological and economic value of woodlands; extend woodland areas; develop the social function of forests, securing the involvement of local communities, in coalfield and other rural areas, in the management and maintenance of the Community Forest.

Measure 26 aims to, "broaden the skills base of the agricultural and forestry workforce".

Its objectives are to: Support the development of human capital in association with interventions supported by other EAGGF Programme Measures; develop new modes of provision and skills training that will increase the participation of atypical workers in farming and forestry; develop portfolios of transferable skills.

Within this latter measure it should be possible to consider ecological analysis as a potential topic. SYF are interested in water issues and flood control and support work by the Environment Agency in developing ox-bows in the Dearne valley.

Forest Plan core area.

There are significant opportunities for public recreation for example in the whole of the Rother valley and in the Upper Don catchment around the Stocksbridge Steel Valley Project. Secondary to the main recreational opportunities are that these should provide access to, and enjoyment of, the rich industrial and other historical heritage. The problem is always how to fund these projects.

Constraints on the implementation of the plan.

Time - i.e. any one venture needs resource allocation to 'work up'.

Money - there is never enough although it is prioritised by the SYF Business Plan which looks at opportunities and strategic aspirations.

Commitment - there is a political imperative for 'ownership' which restricts cross-boundary work.

Technical issues - is the land needed available? Are there land use planning issues and constraints?

The Trans Pennine Trail does provide significant opportunities for developments connecting to it.

Accessibility needs to be a feature of development.

SYF and tourism.

The emphasis for SYF is on local-based tourism and recent work has been in developing local leisure guides. There is New Opportunities Fund grant aid to develop a web site about linking people to environmental resources thus increasing the use of 'places' and therefore increasing spending to boost local economies. Outdoor attractions in South Yorkshire in respect of places and routes/trails are promoted. These are not intended specifically as tourism initiatives for tourism but are 'knock-ons' from other initiatives.

Industrial trends.

Two types of 'sites' in South Yorkshire:

1. The easiest sites to develop: Because of access; flat land; availability of subsidies.
2. Under EU Objective 1 strategic direction: Strategic Economic Zones:
   - M1 corridor; M18 corridor; Dearne Valley.

The infrastructure in these areas is prioritised.

Focussed interviews -

Voluntary sector respondents.

Interview with Harry Bowell, RSPB Reserves' Manager, North West Region. January, 2003.

Role with RSPB - Securing acquisitions and supervising major projects.

History of Old Moor reserve within the Dearne Valley.

The Old Moor project was initially a joint initiative of Barnsley and Rotherham MBCs primarily as a restoration project from the dereliction left following the demise of coal mining in the valley. The restoration also resulted from a need by Rotherham MBC for capping material for the former coal tip at Manvers. The old railway sidings serving the coal industry in the Barnsley MBC section of the valley provided material and produced the 'holes' suitable for wetland creation. The restoration scheme also included the site of Wath Ings nature reserve managed by the Yorkshire Wildlife Trust.

EU Objective 2 funding of £3,800,000 was obtained for wetland creation and partial restoration of existing buildings.

Following restoration and habitat creation Barnsley MBC never intended to manage the site on a long-term basis but invited the Wildfowl and Wetlands Trust to take this on. There was initial interest from the Trust, and they were involved in the design process, but later found they were overstretched and had to pull out as they were also involved in major creation projects in South Wales and at Barnes Reservoir in London.

Barnsley MBC then approached the RSPB to take on the site but were rejected as the site did not meet the RSPBs then policies on site acquisition. These were based on a national overview of key bird sites and there was a need for cost effectiveness. For lowland wet grassland sites (which is how Old Moor was categorised) there was a minimum size criteria of 200 hectares with Old Moor, at the time, only being about 100 hectares.

RSPB policy at the time did not take into account the importance of urban fringe sites or of the implications of climate change. However, shortly after this there was a radical change of policy through "RSPB Future Directions 3" business plan which advocated the creation of a few visitor 'spectacle' sites near to large centres of population. Rainham Marsh was the first.

Also around this time negotiations were taking place with the Environment Agency regarding land management of their land holdings within the valley and close to Old Moor. A partnership was developed to manage these sites sympathetically to nature conservation and visitor access whilst retaining their flood holding capacity. This then created a system of linked sites of great importance for birds. In view of this Barnsley MBC again approached the RSPB who were then able to take up the offer in view of the two sets of changed circumstances.

The first task was to map Barnsley MBC and Environment agency land in the valley corridor. The initial focus was on the reality of the existing sites. But the mapping exercise showed that the area of existing and potential sites equated to approximately 325 hectares with the potential to be described as a, *"necklace of wetland jewels"*.

In managing these sites the primary focus was nature conservation but with something different at Old Moor described as, *"nerve-wracking but exciting"*. Potential visitors can be estimated from the following figures:

5,400,000 people live within one hour's drive of Old Moor.

2,000.000 people live within 1/2 hour's drive of Old Moor.

180.000 school children live within 1/2 hour's drive of Old Moor.

Description of the project.

Various funding agencies were used: Heritage Lottery Fund; WREN (Land fill tax); Yorkshire Forward .
and to a lesser extent: Barnsley MBC; various small Trusts. In total - £3,500,000 over the next 5 years.

Future capital funding would improve the visitor infrastructure at Old Moor with footpath links to the other sites (with links to the existing Trans Pennine Trail infrastructure). It was also hoped to improve public transport links.

In terms of expansion of Old Moor as a tourism asset it was intended to develop the retail side to obtain site revenue funding (which would require £220,000 per year of which 80% was for staff).

It was intended that a charge would be made to visit Old Moor (although it would be free for RSPB members) but not for the other sites. It was also hoped to devise a method of providing a free entry policy for the local community.

Education facilities would be developed together with a tea room. The existing farmhouse could be used as a meetings venue for the local community and business. T underpin the decisions for use of the site a questionnaire survey was conducted with current visitors and with the general public to ascertain what people wanted from the site.

The lease for the site was likely to be signed and finalised in March, 2003 for the Old Moor site and acquisition of the other valley sites would progress over the next year. The Environment Agency sites would be considered early in the 2003/4 financial year

In terms of economic and social regeneration the value of the developments had been recognised at a regional level by Yorkshire Forward who would commit £1,000,000 in recognition of the economic benefit of a big nationally recognised RSPB site on the doorstep of new business.

In terms of economic benefit at a national level, the RSPB reserves were in the top 20 visited sites, with £11,000,000 visitor spending contributed to local economies and 300 FTE jobs. As an example Leighton Moss wetland nature reserve in the North West had 10 FTE jobs on site, created 27 FTE jobs in the local economy and 2 FTE jobs through purchasing locally.

The Dearne Valley had a brand as a 'dirty' site following its coal mining past and later dereliction. The Old Moor developments and those on nearby sites would significantly change this brand image giving regeneration funding agencies more incentive to promote and fund schemes in the valley. It also represented a new brand for the RSPB away from its history as catering for, and representing, white, middle-aged and middle class England. It was recognised that there was a risk of being too trendy for the RSPB and that there was the potential to stretch thinly without it being core business.

Other funding could be realised for the Bolton Ings site which has potential for development with large reedbed creation and could attract funding as an EU LIFE reedbed project as a 'stepping stone' site.

Water Framework Directive.

Policy development in relation to the Directive was being addressed by a dedicated Water Policy Team at the RSPB headquarters in Sandy, Bedfordshire, but as yet the policies were not developed enough to have filtered through to regional level. However, it was recognised that the Directive would have significant effects in terms of river basin planning and that the way that the sites around Old Moor had been consulted on, developed and managed would seem to be contiguous with Framework recommendations.

The RSPB were involved with the Environment Agency in river catchment planning in the Aire and Dearne valleys. Concerns centred around increasing flash flooding on the Dearne and the Don with serious concern of the effects in Doncaster. It was recognised that there were flood plain management issues that were critical for Doncaster but that much could be done to alleviate the problem if attention was given to changes in moorland management in the headwaters of the Don to hold back water rather than rapidly drain it downstream. The RSPB would like to see more 'joined-up' thinking in relation to flood events and water quality and would like to promote more extensive use of agri-environment schemes.

The problems identified revolved around the fact that different agencies were responsible for different things in the overall scenario. For instance, upland management was an issue for land use planning on which the Environment Agency had little significant influence. The challenge was to get those responsible for flood defence and nature conservation to work effectively together.

Flooding issues.

Of the Dearne valley sites which the RSPB had an interest the Bolton Ings site development would be classed as flood defence neutral. The Environment Agency will not accept designs for restoration/creation that were mainly

for nature conservation with additional flood defence capability - it has to be the other way round. Accepting this is helpful in recognising design constraints but it is hoped to show that the proposals for all the sites in the valley will show that nature conservation aspects are marginal to flood containment aspects.

The RSPB suggest that the Environment Agency have not yet properly modelled how flooding or the river flood regime actually works. But it was recognised that a commissioned Engineering consultancy as to how to create wetlands in the Dearne valley was the catalyst for current proposals.

Evaluation of projects.

This has to be pragmatic in terms of who owns what and whether there is existing nature conservation interest or whether it is potential.

For both the Bolton Ings and Houghton Washlands sites a hydrological survey would be carried out.

Priority species need to be identified to influence site management and this should be both existing and potential. Targets would be set e.g. nationally - 50 breeding pairs of bitterns by 2025. The questions raised are how this can be realised by management related to knowledge of species habitat requirements. It is suggested that there is a need for a further 2,000 hectares of reedbed to be created, some of which could be in the Dearne valley.

The RSPB must also look for the best deals in terms of ground conditions, ownership issues, costs, levels of access etc. Best use must be made of RSPB resources. At Old Moor it is seen that acquisition of the main site and additions is a positive element. The infrastructure and staff are already in place.

Visitor targets.

Old Moor initially expects 18,000 per year but the target is to increase this to 50,000 per year within 5 years. This is based on the visitor figures for the nearby RSPB Fairburn Ings reserve which has 50,000 visitors per year. The extra visitors will be attracted through better promotion (particularly in view of it now being an RSPB reserve which will be promoted to its 1,000,000+ members). The RSPB have an effective promotion regime. But it is also recognised that regionally this is still a relatively small visitor attraction. In comparison the Peak National Park sites of Longshaw and Fairholmes attract up to 250,000 and 1,000,000 visitors per year respectively. It is recognised that the carrying capacity of Old Moor can accept a significant number of visitors.

Educational aspects of the reserve will be through links to the Dearne Valley College for skills training opportunities and there will be a long-term volunteer centre also linked to opportunities for the College students.

Pollution issues.

The Dearne is much better in terms of quality than 20 years ago but problems with Combined Sewage Outflows and Minewater are still potential problems that, in the latter case, are not easily predictable. However, there is the potential for tertiary treatment using reedbeds which will have additional wildlife interest and could be used as a crop for bio-fuel. Thus multi-use sites for nature conservation, water treatment and bio-fuel which could be linked to an agri-environment scheme.

A feasibility study is to be commissioned for investigation of the use of reed as a bio-fuel as a space heater in the Old Moor centre and to identify potential sites in the Don, Dearne and Aire catchments as multi-use sites.

Written response from Christine Handley, Chair, Woodhouse Washlands nature reserve management committee. **August, 2003.**

Proposed topics for discussion re the River Don, its tributaries and associated wetlands.

* **Strategic thinking on River Rother catchment and / or specific stretches.**

The reserve doesn't have a specific vision for river catchment planning as it hasn't really been discussed at a committee meeting. My own view is that catchment planning is crucial to making sure that the reserve can fulfil its potential and become a more diverse predominantly wetland site. It also needs to be developed to take into account the potential for the proposed Chesterfield Canal Link. The reserve's management plans (original and update) refer to the River Rother Wildlife Strategy, the Local Authorities' countryside strategies and biodiversity action planning and see the site as one part of a mosaic of different habitat types along the Rother corridor. As the site is owned by the Environment Agency it is mentioned / covered in their LEAPs document. The reserve is managed under a Countryside Stewardship Scheme looking at enhancing riverside habitat. One of the constraints is the fact that the reserve is part of the flood control system for the whole Don , Dearne, Rother catchment. This means that we have to look at any work we may want to do in the context of flood capacity should the reserve need to be used and the robustness of any structures we may want to put on the reserve. One of the boardwalks constructed as part of the Transpennine Trail is very substantial as it goes over one of the main water inflows if the reserve needs to be flooded and has to withstand a great deal of pressure. It could be constructed but to a higher specification than you would normally expect given the situation.

* **What does the reserve management think will be the immediate effects of the Water Framework Directive for the organisation?**

We haven't discussed this at a committee meeting so I can't really comment.

* **Identification of key wetland areas and / or river stretches in the catchment area.**

This was undertaken several years ago as part of the River Rother Wildlife Strategy referred to earlier. The Washlands area was identified as a potential for a nature reserve and its identification there probably added weight to it being declared. The Chesterfield Canal partnership and British Waterways have been very active in this area recently trying to promote the benefits to wildlife and biodiversity of turning the Rother into a canal link. The environmental assessment looking at the current position of sites along the Rother didn't seem to bear that out. Within the reserve we have areas earmarked for development as wetland (wet grassland/ marsh/ fen/ ponds) rather than drier grassland but we have some areas of species rich drier grassland that we would also want to encourage. The reserve is quite large so can accommodate both.

* **What key economic associations are there in the river corridor?**

There is a lot of potential for further development of leisure and recreation facilities at Rother Valley Country Park and within the local nature reserves linked by the Trans-pennine trail. Coal field Regeneration monies and Objective 1 money via the Beighton Village Development Trust are being used to facilitate some of the economic and social regeneration for the area. However this is poorly linked to nature conservation objectives in the local area and targeted at specific sites rather than being distributed based on 'need'. There has also been some success in attracting heritage lottery type funding to employ workers to provide educational and social activities in local areas which helps to further some of the nature conservation aims. I personally don't think that this part of the regeneration programme has been thought out properly and imaginatively in terms of nature conservation only in providing recreational facilities which may generate income for local businesses. The Chesterfield Canal trust have commissioned a study to look at the economic benefits of creating a canal link along the Rother.

* **What major pollution issues are there in the river catchment in the vicinity of the reserve?**

Nowadays the main pollution issues affecting the reserve are storm water and surface water discharges either directly onto the site or into the river and ochreous deposits in parts of the ditches. There may be secondary problems of heavy metal / chemical pollution (from former industry) if sediment from the river and in the substrate is disturbed. There is occasional smoke pollution from adjoining factories but I'm not sure whether any of this falls onto the reserve. The river now supports a fish population which it was unable to do up to a few years ago.
We have encouraged the construction of holding/ settling areas with reeds etc to take some of the surface water discharge from nearby housing developments. The primary reason for these schemes was not necessarily to mitigate for pollution but as a way of making sure the ground water / spring water coming from the developments wasn't lost to the reserve and either put straight into the river or down to the sewage works. There are plans to replace the storm drain overflows which discharge into the Shire Brook and then the Rother in the next few years. This should then get rid of that source of pollution.

* **How do flood control measures enhance or restrict nature conservation objectives for the reserve interests in the catchment?**

As stated earlier the primary function of the reserve site is as a flood control storage area. The channelisation/ ditches and some of the topographical features are a direct result of the creation of the flood control area in the late 1950s. This has fundamentally altered the 'nature' of the site since then as it is no longer allowed to flood naturally several times a year. If we wanted to re-create the reserve as it was then with extensive areas of wetland we would have serious problems in getting and keeping all parts of the site wet enough throughout the year. However, the way the site has developed because of the initial work has created its own interest and challenges that the management plans can work within. One dilemma now would be what would be the effects on the biodiversity and nature conservation interest if the reserve started to be flooded again on a regular basis. My view would be to keep things as they are as this contributes to a greater diversity of sites along the river corridor.

- **What partnerships do you envisage will exist with the reserve management to promote river/wetland management and other initiatives in the catchment area?**

We have already developed links with the local community, schools and other groups over the years and will continue to do so as new projects are being developed. One of the aims is to inform people about the importance and engage them with the way the nature reserve needs to be managed. As the reserve is owned by the Environment Agency and leased to the YWT we already have strong links there that will continue to develop. Similarly, we have developed links with local authorities from the beginning and both Rotherham and Sheffield are represented on the management committee. Other partnerships will probably be more project based and develop as and when needed.

* **What funding issues are there?**

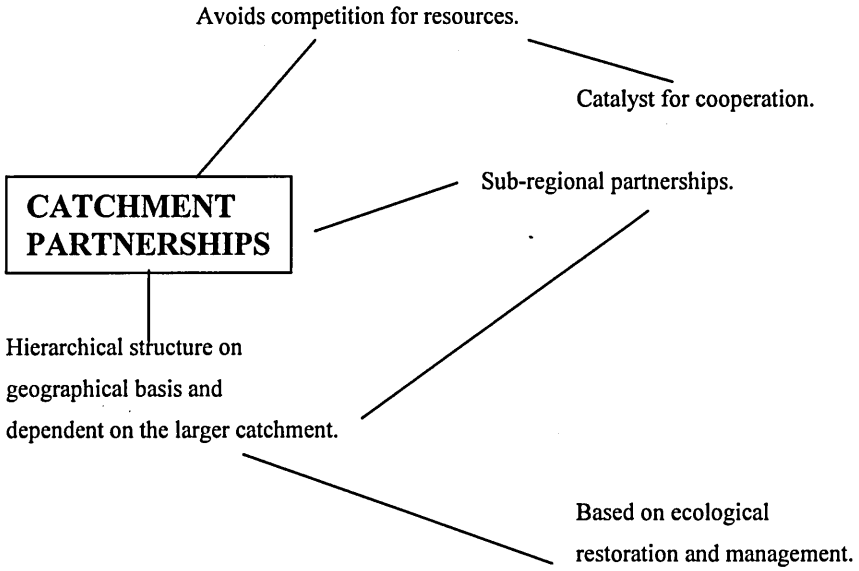
As with any voluntary / charitable organisation there are always issues around needing to raise funds to continue to operate and undertake projects that are needed to maintain and develop the nature reserve. We try to tap into (and have and intend to in the future) some of the major regeneration monies around but there is a degree of skill in making your bid the most attractive when competing with many other very similar projects and this is one of the problems as there never seems to be enough to go round.

* **What policy documents exist related to river catchment issues?**

River Rother Wildlife Strategy, EA's policy documents, Wildlife Trusts' Rivers Project

Christine Handley, August 03

Strategic thinking (vision).



The vision of other authorities.

* The Trust has few links to anyone.
* The Trust doesn't really pay much attention to the local LEAP.
* There is a conflict of visions in terms of scale.
* Unclear as to what the Upper Don Strategy Group does.
* In relation to the Sheffield Environment Strategy (draft) the Trust has been involved in the consultations and provided a three-year shopping list and their record of achievements to promote.
* The Sheffield Nature Conservation Strategy is the only comprehensive overview of the natural heritage of the city but it is outdated and needs a revamp using GIS.
* The Trust is involved in implementing the Sheffield Parks Regeneration Strategy.
* There has been a minor revamp of the Sheffield Inner City Habitat Survey originally developed in the mid 1980s with the help of Sheffield City Council.
* In relation to the umbrella body of the Wildlife Trusts Partnership Plan the Trust are aware of the Water and Wetlands Policy Team at the Wildlife Trusts head office, but don't have a strong link with them.

Barriers.

* The weak economy
  - There is a limited pot of money and the environmental sector takes a low priority
  - Attracting inward investment means political chasing of advantages at the expense of quality and environmental opportunities
* Lack of political
  - Perception and prioritisation of environmental issues
  - courage and vision
* A reactive planning
  - governed by the Town and Country Planning system Act.
* Lack of commercial risk-taking
  - Rivers in good condition = good investment
  - Rivers in bad condition = poor investment.
* Organisational rivalry.

*	Suspicions over legal	-	Wariness re Sustainable Urban Drainage Systems risk-taking (SUDS) management liability.

Water Framework Directive.

The question to be asked is what, if any, role do local organisations have to play on such large-scale initiatives? There may be a sub-regional role, but how is that defined? No involvement by the Trust at the moment but it is envisaged that over the next few years there will be a direct impact on other organisations and funding bodies which will provide the Trust with opportunities to do wetland work. There are many exciting possibilities yet to be developed. The Trust recognises there will be increased partnership opportunities. The Trust may grow and could be linked with the Yorkshire Wildlife Trust with other links across South Yorkshire and this may be far in the future. This means that there is a growth of scale at which the Trust can work. However, if the Trust remains locally based then there will only be small scale partnership involvement in projects. Their minimum involvement would be in regional consultations. The WFD may have implications for a change in the Trust's campaigning focus.

Key areas of the Trust's work.

Original work on LBAP was in helping the community to be involved in the process and monitoring effects. This later developed into the creation of Wild Web and targeted enhancement projects. A desk study of river data was conducted and found that this was out of date and inadequate but it did allow recognition of where to pinpoint survey work for the future.

Previous surveys include:

* 2001 - River Sheaf was resurveyed
* 1999 - A one mile stretch of the upper Don was surveyed
* 2002 - Freshwater invertebrate surveys of the River Moss and the Wyming Brook as links to adjacent SWT managed nature reserves, were carried out
* 2002 - Desk study of existing data for Blackburn Meadows nature reserve carried out
* 2003 - NVC survey of Blackburn Meadows nature reserve to be carried out (possibly as Phase 1 survey with NVC categories).

Site identification.

Based on hearsay and opportunistic! Current data is not sufficient to make reasoned judgements. Data should be linked to the Nature Conservation Strategy but not as a one-off - it should be a continuous process. May use an adapted version of the Radcliffe Criteria in the future.

Economic associations.

There were recent missed opportunities to de-culvert, 'naturalise', implement habitat creation projects and develop access whilst a large section of land adjacent to the River Sheaf was being redeveloped.

SWT are involved in a partnership with Darnall Community Enterprise, Sheffield City Council, the Sheffield Groundwork (when formed) and British Waterways to strategically enhance greenspace and workspace on a swathe down the industrial sector of the Don Valley in Sheffield and centred on the Sheffield to Tinsley canal.

SWT strategically looking at creating an economic regeneration community enterprise corridor along the River Sheaf and linking to the River Don and the canal.

SWT involved in the regeneration project on the Chesterfield canal with a link to the River Rother with potential economic interest.

Pollution issues.

SUDS issues:

- A scheme has been built into housing redevelopment at Jervis Lum, Norfolk Park district, where SWT are doing the landscaping

- A scheme involving experimental fishing ponds has been developed at Deep Pits on the Manor estate and this seems to have been successful

SWT has a desire to create new schemes in the Sheaf valley. Sheffield City Council Housing Department are looking for exemplar housing that has been environmentally developed and there seems to be a project in north Sheffield where it is hoped SWT will be involved in the landscaping.

Flood control.

SWT has a nature conservation interest at the strategic consultation level but is not involved in any actual projects.

Partnerships.

* Attercliffe Corridor developments.
* In the Sheaf valley with Heeley Development Trust, Groundwork (when formed), Sheffield City Council and local organisations.
* Sheffield First for the Environment (where a focus is being put on river corridors)
* Work on LBAPs with involvement on writing drafts for 'Rivers and Running Waters', 'Ponds and Standing Waters' and 'Otters'.
* Several other links on projects with Sheffield City Council.
* Links with Rotherham MBC at the Blackburn Meadows nature reserve.

There is a hesitation to be involved with the EA who don't seem to encourage partnership.

Funding issues.

Issues of development capacity - rely on project funding which can be stretched to create new projects (but this also stretches the work capacity of the organisation). Issues related to survey and monitoring - no-one wants to give money for these essential project elements and therefore must be built into other elements of projects. Issues of communication - agencies operate at different scales and there is a lack of understanding because there are also scales of priorities. There are close relationships with other agencies or organisations that are working at the same scale. Spare capacity and funding to enable better communications would help. SWT have enthusiasm, knowledge and expertise but are frustrated by the difficulties in obtaining funding - particularly for revenue elements such as staffing and maintenance.

Policy documents being worked with.

Sheffield Nature Conservation Strategy.

LBAPs.

Written response from Roger Mitchell, Yorkshire Wildlife Trust, South Yorkshire Area, former Chair of YWT and retired local government officer with a remit for regeneration and restoration. October, 2002.

Dear Geoff,
At the end of May you asked me to comment on the above. I didn't do so right away and subsequently your information slipped out of sight (and I'm afraid out of my mind) in my in tray. I do apologise therefore for this long delay in replying but hope that my rather scanty response is of some assistance to you.

1. One issue you might care to ponder on in terms of the rationale for the study is the extent to which wetlands in particular I believe need to operate on a threshold of awareness among the population. Once wetlands dotted around in a landscape assume a certain critical mass, then I would suggest that the level of awareness of them on the part of the public increases massively. In England, the Norfolk Broads is a good example but there are many abroad such as Le Brenne and the "canals" of Vendee France. With this level of awareness, these areas are able to have a much greater social and economic impact largely through tourism. Looking at South Yorkshire, there may be possibilities in this respect around the Dearne Valley where a ribbon of ponds and meres within the river valley has begun to develop. Flood alleviation schemes may add to these possibilities. Some similar opportunities may exist in the Went valley on the boundary with North Yorkshire and around Hatfield and Thorne Moors.

In the Dearne Valley, a niche tourism based on the keener naturalist (mainly birdwatchers) will undoubtedly develop, but the attraction of the area to a more general visitor will be inhibited by the poor quality of parts of the urban environment throughout the valley. People visit the Norfolk Broads and the Vendee canals as much to enjoy the ambience of rural villages as to potter about as in Vendee, in unmanoeuvrable boats!

2. The connection between town and country: whilst there is interest in creating wetlands close to urban areas, the opportunities are limited. However, no existing or newly created wetlands in South Yorkshire would be far from urban populations. What is missing here is the creation of easier access to the countryside on foot, by cycle or public transport. The Sykehouse, Fishlake and Fenwick areas north east of Doncaster are a good example of an attractive landscape which could be greatly enhanced, under existing agricultural and flood relief policies, to become much more attractive to large populations of urban dwellers in former mining communities at Thorne, Stainforth, Hatfield and Askham. What is missing is any kind of structure to enable people to visit the area using sustainable transport means.

3. The Lee Valley Park, which I am sure you know all about, is to me a good example of the social impact of wetlands on local communities.

4. Turning to a specific site, Ian Rotherham currently has the bid documents to HLF relating to Potteric Carr. These set out a number of social and economic aspects of the Potteric Carr initiative and you might care to have a look at them. Ian will have them for a little while longer in the course of some work which he is doing on the social and economic impact of wetlands, but I will be taking them back from him fairly soon since we need them in the Trust.

5. Public awareness : promotion of the use of wetlands in the county is minimal. The reasons for this are resources. NGOs have limited resources for promoting their nature reserves for example but even to do so would create more problems in site management which is mainly on a voluntary basis. The social and economic benefits of existing wetlands would increase enormously if there were more resources available for management of the sites and their marketing, which would need to be done on a comprehensive basis so that individual sites could be targeted at very local communities, but all sites in a particularly grouping, e.g. Dearne Valley, could be marketed more widely, particularly in niche sectors such as birdwatching.

6. We are looking, at Potteric Carr, at establishing an intermediate Labour Market team which would be involved in the production of commercial products based on resource material from the Potteric Carr Reserve. For instance, coppiced willow would be use to create woven mats for river bank reinforcement whilst reed seed would be collected for propagation and onward sale. The commercial possibilities are limited but will help to demonstrate the diverse benefits of wetlands.

7. Funding issues are an interesting one. The EU Life fund is the only one I know which periodically changes its priorities and focuses on particular issues. For instance, it is currently supporting the second reed beds for bitterns initiative through the EU. Potteric Carr is one of the chosen sites for England. If more grants such as landfill tax receipts and aggregate tax levy could be targeted in this way on a cyclical basis, then there would be much greater benefits for particular habitat types such as wetlands for the reason that, when the turn of wetlands comes round, the combining of a range of grants within a limited period of time would have a dramatic impact in developing the value of wetlands on a strategic basis.

Geoff, these are just some thoughts which I hope are helpful. I'm afraid they are rather scanty but if you care to give me a ring at any time with regard to particular points I will be happy to have a chat with you.

With kind regards, Roger Mitchell